COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

BULLETIN No. 131.

PROCEEDINGS

OF THE

STATE BOARD OF AGRICULTURE,

AND

FARMERS' NORMAL INSTITUTE.

COMPILED BY A. L. MARTIN,
Deputy Secretary and Director of Institutes.

HELD IN THE

Court House, Bellefonte, and at State College, Penna.,

OCTOBER 11-14, 1904.

1904.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA,
1904.

VIRTUE
LIBERTY AND
INDEPENDENCE

SUMMARY OF CONTENTS.

	Page.
Members of the State Board of Agriculture,	9
Proceedings of Meeting of State Board of Agriculture,	13
List of County Chairmen and Lecturers,	25
Program, Annual Meeting Farmers' Normal Institute,	29
Proceedings of Farmer's Normal Institute,	33
Address of Welcome, for Bellefonte, Col. James P. Coburn,	37
Response to Address of Welcome, Hon. A. L. Martin, Deputy Secretary and Director of Farmers' Institutes,	39
Commercial Fertilizers, Prof. M. S. McDowell,	43
Round Table, Prof. McDowell,	53
Domestic Science in the Public Schools, Mrs. Wells W. Cooke,	63
The Country Home, Its Sanitation and Convenience, Mrs. Mary A. Wallace,	71
Normal Schools of Agriculture for Institute Workers, Prof. John Hamilton,	77
Address of Welcome for State College, Dr. G. W. Atherton,	92
Response to Address of Welcome, Alva Agee,	99
Animal Nutrition, Dr. H. P. Armsby,	102
Round Table—Section A, Dr. Armsby,	109
The Principles of Plant Feeding, Prof. W. A. Buckhout,	116
Round Table, Prof. Buckhout,	117
The Farmer's Cow; Her Care, L. W. Lighty,	118
Principles of Animal Breeding, Prof. G. C. Watson,	125
Feeds and Fertility, Dr. I. A. Thayer,	133
Round Table, Prof. Watson and Dr. Thayer,	135
Fruit Culture—Orchard Fruit, Prof. G. C. Butz,	140
The Pruning of Fruit Trees, Dr. J. H. Funk,	142
Round Table, Prof. Butz and Dr. Funk,	149
The Art of Instruction, Prof. W. G. Johnson,	152
The Influence of a Local Institute Worker, T. D. Harman,	159
The Care of Milk and Butter, Prof. T. I. Mairs,	164
The Effects of Feed on the Quality and Quantity of Milk, Prof. Wells W. Cooke,	178
Round Table, Profs. Mairs and Cooke,	183
Market Gardening, Prof. R. L. Watts,	191
Round Table, Prof. Watts,	197
Insect Prevention, Prof. H. A. Surface, Economic Zoologist,	200
Round Table, Prof. Surface,	209
Potato Culture, Alva Agee,	212
Round Table, Mr. Agee,	214
Nature Study and Agriculture in the Public School, D. J. Crosby,	216

Page.
Our Insect Friends, Prof. H. A. Surface, ... 218
Egg-Production, J. T. Campbell, ... 220
Bee-keeping, R. D. Barclay, ... 224
Round Table, Mr. Barclay, ... 226
Round Table, Prof. Menges, ... 228
Round Table, Mr. Campbell, ... 232
Round Table, Mr. Barclay, continued, ... 234
The County Chairman, Hon. Jason Sexton, ... 238
The Organizing of Institute Committees, their Work and Importance, H. W. Northup, ... 242
Advertisement of Institutes, Geo. A. Woodside, ... 247
Resolutions, ... 250
Round Table, Mr. Sexton, ... 252

PREFACE.

Commonwealth of Pennsylvania,
Department of Agriculture,

Harrisburg, Pa., November 17, 1904.

The following bulletin, No. 131, will commend itself to all thoughtful readers. The Farmers' Institute work has been carried on under State control for a period of 27 years. As a result of this work the elements of agricultural knowledge have been brought within the reach of all our citizens, and the Pennsylvania farmer of to-day has a much better understanding of the scientific principles underlying his occupation than was possessed by the farmer of fifteen or twenty years ago.

The progress that has been made in all that relates to agriculture, calls for a still broader training on the part of those who are sent out by this Department as Farmers' Institute lecturers, and to this end the Farmers' Normal Institute has been established. The proceedings of this Normal Institute for 1904, are published in bulletin form, so that the benefit of the valuable papers read and addresses delivered may become available to as many of the farmers of the State as possible.

N. B. CRITCHFIELD,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

Commonwealth of Pennsylvania,
Department of Agriculture,
Harrisburg, November 15, 1904.

Hon. N. B. Critchfield, Secretary of Agriculture:

Dear Sir: I have the honor to present herewith a Bulletin containing "Proceedings of the Farmers' Normal Institute," held at Bellefonte and State College, Pa.; also, full list of such papers and addresses as were presented, together with questions and answers relating to the same.

Very respectfully,

A. L. MARTIN,
Deputy Secretary and Director of Institutes.

MEMBERS

OF THE

PENNSYLVANIA STATE BOARD OF AGRICULTURE,

FOR THE YEAR 1904.

Members Ex-Officio.

HON. SAMUEL W. PENNYPACKER, Governor.
MAJ. I. B. BROWN, Secretary of Internal Affairs.
DR. N. C. SCHAEFFER, Superintendent of Public Instruction.
DR. G. W. ATHERTON, President of The State College.
HON. WM. P. SNYDER, Auditor General.
HON. N. B. CRITCHFIELD, Secretary of Agriculture.

Appointed by the Governor.

R. I. Young, Middletown, Dauphin County, ...Term expires 1905
Col. R. H. Thomas, Mechanicsburg, Cumberland County, ...Term expires 1906
Gen. James A. Beaver, Centre County, ...Term expires 1907

Appointed by the State Poultry Association.

Norris G. Temple, Pocopson, Pa., ...Term expires 1906

Elected by County Agricultural Societies.

			Term expires.
Adams,	A. I. Weidner,	Arendtsville,	1906
Allegheny,	J. S. Burns,	Imperial, R. F. D. No. 1,	1906
Armstrong,	S. S. Blyholder,	Neale,	1905
Beaver,	A. L. McKibben,	New Sheffield,	1905
Bedford,	S. S. Diehl,	Bedford,	1906
Berks,	H. C. McGowan,	Geiger's Mills,	1907
Blair,	F. Jaekel,	Hollidaysburg,	1907
Bradford,	E. E. Chubbuck,	Rome, R. F. D. No. 16,	1907
Bucks,	W. T. Davis,	Ivyland,	1906
Butler,	W. H. H. Riddle,	Butler,	1906
Cambria,	H. J. Krumenacher,	Nicktown,	1906
Cameron,	W. K. Howard,	Emporium,	1906
Carbon,			
Centre,	John A. Woodward,	Howard,	1906
Chester,	M. E. Conard,	Westgrove,	1906

			Term expires.
Clarion,	S. X. McClellan,	Knox,	1907
Clearfield,	J. W. Nelson,	Shawville,	1907
Clinton,	J. A. Herr,	Mill Hall, R. F. D.	1905
Columbia,	H. V. White,	Bloomsburg,	1906
Crawford,	M. W. Oliver,	Conneautville,	1904
Cumberland,	Chas. Mullen,	Mt. Holly Springs,	1906
Dauphin,			1903
Delaware,	J. Milton Lutz,	Llanerch,	1904
Elk,			1903
Erie,	S. D. West,	Wattsburg,	1907
Fayette,			1903
Forest,	C. A. Randall,	Tionesta,	1907
Franklin,	C. B. Hege,	Marion,	1905
Fulton,	R. M. Kendall,	McConnellsburg,	1907
Greene,	N. M. Biddle,	Carmichaels,	1907
Huntingdon,	Geo. G. Hutchison,	Warrior's Mark,	1906
Indiana,	S. M. McHenry,	Indiana,	1907
Jefferson,	W. L. McCracken,	Brookville,	1907
Juniata,	Matthew Rodgers,	Mexico,	1906
Lackawanna,	Henry W. Northup,	Glenburn,	1906
Lancaster,	W. H. Brosius,	Drumore,	1907
Lawrence,	Sam'l McCreary,	Neshannock Falls,	1906
Lebanon,	H. C. Snavely,	Cleona,	1907
Lehigh,	P. S. Fenstemaker,	Allentown,	1907
Luzerne,	J. H. Snyder,	Trucksville,	1907
Lycoming,	A. J. Kahler,	Hughesville,	1906
McKean,	J. B. Colcord,	Port Allegany,	1906
Mercer,	W. C. Black,	Mercer,	1905
Mifflin,	M. M. Naginey,	Milroy,	1907
Monroe,	R. F. Schwarz,	Analomink,	1905
Montgomery,	J. Sexton,	North Wales,	1905
Montour,			1904
Northampton,	W. F. Beck,	Nazareth,	1906
Northumberland,	J. A. Eschbach,	Milton,	1905
Perry,	A. T. Holman,	Nekoda,	1907
Philadelphia,	E. Lonsdale,	Wyndmoor,	1907
Pike,			
Potter,			
Schuylkill,	W. H. Stout,	Pinegrove,	1906
Snyder,	J. F. Boyer,	Mount Pleasant Mills,	1906
Somerset,	Jacob S. Miller,	Friedens,	1904
Sullivan,	J. K. Bird,	Dushore,	1906
Susquehanna,	E. E. Tower,	Hop Bottom,	1907
Tioga,	F. E. Field,	Wellsboro,	1905
Union,	J. Newton Glover,	Vicksburg,	1905
Venango,	August Morck,	Oil City,	1904
Warren,	R. J. Weld,	Sugargrove,	1904
Washington,	D. M. Pry,	Burgettstown,	1905
Wayne,	Warren E. Perham,	Niagara,	1907
Westmoreland,	M. N. Clark,	Claridge,	1907
Wyoming,	D. A. Knuppenburg,	Lake Carey,	1907
York,	B. F. Koller,	Shrewsbury,	1904

OFFICERS.

PRESIDENT.

Hon. Samuel W. Pennypacker, Governor, ... Harrisburg.

VICE PRESIDENTS.

Jason Sexton, ... North Wales.
H. W. Northup, ... Glenburn.
M. N. Clark, ... Claridge.

EXECUTIVE COMMITTEE.

Hon. Samuel W. Pennypacker, ... Harrisburg.
A. J. Kahler, ... Hughesville.
H. C. Snavely, ... Cleona.
Matthew Rodgers, ... Mexico.
S. X. McClellan, ... Knox.
H. G. McGowan, ... Geiger's Mills.
N. G. Temple, ... Pocopson.
S. M. McHenry, ... Indiana.
R. F. Schwarz, ... Analomink.
J. Newton Glover, ... Vicksburg.
N. B. Critchfield, *Secretary*, ... Harrisburg.

ADVISORY COMMITTEE.

N. B. Critchfield, *Secretary*, ... Harrisburg.
H. G. McGowan, ... Geiger's Mills.
A. J. Kahler, ... Hughesville.
R. F. Schwarz, ... Analomink.

CONSULTING SPECIALISTS.

Botanist, ...	Prof. W. A. Buckhout, ...	State College.
Pomologist, ...	Cyrus T. Fox, ...	Reading.
Chemist, ...	Dr. William Frear, ...	State College.
Vet. Surgeon, ...	Dr. Leonard Pearson, ...	Philadelphia.
Sanitarian, ...	Dr. Benjamin Lee, ...	Philadelphia.
Microscopists and Hygienists,	Prof. C. B. Cochran, ...	West Chester.
	Dr. Geo. G. Groff, ...	Lewisburg.
Entomologists, ...	Dr. H. Skinner, ...	Philadelphia.
	Prof. Franklin Menges, ..	York.
Ornithologist, ...	Prof. H. A. Surface, ...	Harrisburg.
Meteorologists, ...	E. R. Demain, ...	Harrisburg.
	J. L. Heacock, ...	Quakertown.
Mineralogist, ...	Col. Henry C. Demming,	Harrisburg.
Apiarist, ...	Prof. Geo. C. Butz, ...	State College.
Geologists, ...	Dr. M. E. Wadsworth, ...	State College.
	Col. Henry C. Demming,	Harrisburg.

STANDING COMMITTEES.

LEGISLATION.

Hon. W. H. Brosius, Chairman, ...Drumore.
Hon. Jason Sexton, ...North Wales.
Hon. A. J. Kahler, ...Hughesville.
G. G. Hutchison, ...Warriors' Mark.
S. M. McHenry, ...Indiana.

CEREALS AND CEREAL CROPS.

A. T. Holman, Chairman, ...Nekoda.

ROADS AND ROAD LAWS.

P. S. Fenstemaker, Chairman, ...Allentown.

FRUIT AND FRUIT CULTURE.

John F. Boyer, Chairman, ...Mt. Pleasant Mills.

DAIRY AND DAIRY PRODUCTS.

Dr. M. E. Conard, Chairman, ...Westgrove.

FERTILIZERS.

Howard G. McGowan, Chairman, ...Geiger's Mills.

WOOL AND TEXTILE FIBRES.

Samuel McCreary, Chairman, ...Neshannock Falls.

LIVE STOCK.

D. A. Knuppenburg, Chairman, ...Lake Carey.

POULTRY.

Norris G. Temple, Chairman, ...Pocopson.

FORESTS AND FORESTRY.

Dr. J. T. Rothrock, Chairman, ...West Chester.

APIARY.

J. W. Nelson, Chairman, ...Shawville.

FLORICULTURE.

Edwin Lonsdale, Chairman, ...Wyndmoor.

PROCEEDINGS OF THE PENNSYLVANIA STATE BOARD OF AGRICULTURE, AT A MEETING HELD IN THE COURT HOUSE, BELLEFONTE, PA., MONDAY 10.30 A. M., OCTOBER 11, 1904.

ORDER OF BUSINESS.

Call to order at 10.30.

1. Roll-call of Members.
2. Reading of Minutes.
3. Appointment of Committee on Credentials.
4. Reception of Credentials of Members-elect and Delegates.
5. Address: "The Relation of the State Board of Agriculture to the Farmer and Farmers' Organizations." S. S. Blyholder, Armstrong County.
6. Report of Committee on Credentials.
7. Unfinished Business.
8. New Business.
9. Miscellaneous Business.
10. Adjournment.

N. B. CRITCHFIELD, Secretary of Agriculture, called the meeting to order promptly at the time designated, and announced as the Chairman for the session, Hon. Jason Sexton, of North Wales, Pa.

The CHAIRMAN: Gentlemen of the Board of Agriculture: I am pleased to be with you this morning and to have the privilege of handling the gavel just for a moment, and calling you to order. It seems that we are to have but one meeting of the Board of Agriculture, so that we will need to be prompt in the transaction of business. The first thing in order will be the calling of the roll.

The Secretary of the Board, N. B. Critchfield, called the roll and the following answered to their names:

A. I. Weidner, S. S. Blyholder, F. Jaekel, John A. Woodward, S. X. McClellan, J. A. Herr, R. M. Kendall, Geo. G. Hutchison, Matthew Rodgers, Henry W. Northup, P. S. Fenstemaker, A. J. Kahler, R. F. Schwarz, J. Sexton, W. H. Stout, J. K. Bird, E. E. Tower, Warren E. Perham, M. N. Clark and D. A. Knuppenburg.

The CHAIRMAN: The next thing in order will be the reading of the minutes of the last meeting.

Minutes of the last meeting were read by Secretary Critchfield and, on motion, they were approved.

The CHAIRMAN: You have listened to the reading of these excellent minutes. I think it certainly deserves a vote of thanks for the splendid manner in which the Secretary has written them up.

It having been moved and seconded that Secretary Critchfield be given a vote of thanks, the same was agreed to.

The CHAIRMAN: The next thing in order is the appointment of a Committee on Credentials. The Chair will appoint Mr. Herr, of Mill Hall, Mr. Schwarz, of Analomink, and Mr. Stout, of Pinegrove. If there are any certificates for the election of new members or re-election of old members, please send them to the Chairman of that committee, Mr. J. A. Herr.

A Member: There might be some delegates here from the Horticultural Society who have been sent as delegates.

The CHAIRMAN: It is perfectly proper for them to hand in their certificates or credentials to the Committee on Credentials. If there are any such, please send them in.

While the Committee examine these certificates we will listen to an address of Mr. S. S. Blyholder, of Armstrong county, on "The Relation of the State Board of Agriculture to the Farmer and Farmers' Organizations."

MR. BLYHOLDER: Mr. Chairman, I feel as though it was almost an impossibility for me to talk to you at the present time. I apprehend that the reason that this address was placed there is, that, as you will remember, at the January meeting I was assigned a subject similar to this. I failed to present it at that time because of sickness, and I feel as though it was an imposition for me to take up the time now; I therefore, feel like asking you, Mr. Chairman, to allow me either to submit my paper to be printed with the proceedings of the meeting or hold it over to the January meeting. If you feel like doing that, I would certainly be glad to comply with either at your pleasure.

The CHAIRMAN: What is the pleasure of the Board? Shall we listen to his paper now?

SECRETARY CRITCHFIELD: Mr. Chairman: By way of explanation, let me say that it may take some time for the Committee on Credentials to do its work, and we do not have a very full program and will want to do something this morning. I think it would be a good thing to have that paper come in right here while there is time

to read it, and I believe we shall be able to give Brother Blyholder all the time he will want. There might be some suggestions in this paper that would lead us to ask for legislation. I do not know what the paper is going to be.

MR. BLYHOLDER: It is not in the form of a paper, what I have to say. I saw it was to be an address and I never like to impose a paper when it is expected to be an address; but as you desire me to speak on the subject, I want to say to you that I will simply give you a skeleton of my thoughts along this line.

Mr. Blyholder then addressed the Board as follows:

THE RELATION OF THE STATE BOARD OF AGRICULTURE TO THE FARMER AND FARMERS' ORGANIZATIONS.

When we get to looking at this subject and view it as it exists at present, from the status of the law or from the action of the farmer in general, we might be led to conclude that there is no relation existing between the State Board of Agriculture and the farmer, that is, to any great extent, because we do not find that connection between the State Board of Agriculture and the individual farmer of of the State that should exist, nor do we find that relation existing between the State Board of Agriculture and the various organizations of the State that there should be.

We will find, I think, by looking back, by comparison, that the State Board of Agriculture was instituted by those who originated it for the betterment of the conditions of the farmer; for the education of the farmer along certain lines which will advance his interests and prepare him better for that grand work which he is doing for us now; in short, that is the object of the State Board of Agriculture. And, further, it was so arranged that it might have a representative in every county in the State, that by so doing, it might work out so that the whole State and everybody therein engaged in that pursuit might be benefited by it; but when we get along these lines and reason there, I fear we fail to find the benefit for which it is intended, nor do we find that co-operation and working together of the State Board and the individual farmer in the State, as the original intention was, or that it should be to make it successful in operation.

It seems to me that the objects of the State Board of Agriculture were that the farmers of the Commonwealth might be in continuous communication and connection with a certain head that might be enabled to impart information to the individual farmer along the various branches of agriculture, so that they should be and would be

benefited. Now that is the intention of the State Board, and it is not because of the failure of this Board that our farmers are not receiving the benefit that they should, but because of the failure of co-operation of farmers throughout the State, with that Board with which they should co-operate. I believe that co-operation can be secured if the individual farmer can be interested and that much more benefit will result.

Mr. Chairman, we have the various farm organizations in the State, the county agricultural societies in some counties, and various other organizations in the counties that are organized for the betterment of the condition of the farmer. Now, we have a law under which the members of the State Board are chosen, which defines how the representatives of the State Board of the various counties shall be chosen, and it seems to me that right there you will permit me to make a suggestion that that should be and might be improved. We know for a fact, that in some of our counties, at least, agricultural organizations by name exist, that are not composed of farmers or agriculturists in that county. Now then it seems to me that there might be an improvement right there; we might ask for laws for such improvement, so that these agricultural societies in the counties should be composed of farmers. I know for a fact that in my own county, there is a society which is considered a county society, that I doubt very much, Mr. Chairman, whether there is a farmer a member of it; I doubt it very much, therefore, I want to suggest this to you, that a committee might be appointed from this Board to consider the enacting of such laws as would bring the State Board of Agriculture in closer touch with the farmer by specifying the form of organization that should exist in the county, from the fact that it now exists as I have heretofore stated.

Then again, it seems to me that a closer relation should exist between the State Board of Agriculture and the various other societies, that are working along the same line with the farmer. I think that our work could be very much improved by a closer relationship with the other organizations.

I want to submit this proposition, that laws could be enacted and should be enacted to so advance the organization of county organizations that such organizations should have the very closest connection with the State Board of Agriculture. In studying this question, I find there is great room for improvement right along that line. Laws should be enacted to bring closer together the State Board and the farmers of the State. We are aware that very much good is being done in our meetings and very much more would be done if they could be brought right down to the individual farmer so that they might receive the benefit which is intended to be derived from our coming together.

If in that way our organization was effected so that it could reach down to the townships instead of only to the counties, and that very often not reaching the farmers, then the information—the education that is sent out in the way of information, in the way of bulletins, etc., that are continuously being sent out by the Secretary of our Board, would be at least in hands where they would do good; but it is a fact to my knowledge, that very many of these are sent out to parties who simply lay them down or throw them away and they are never distributed among the farmers for whom they are intended. It does seem to me that along that line we do need a revision of the law; that if a committee was appointed by this Board to prepare and submit to our Legislature a properly drawn bill, that a vast improvement might be made along that line. We could reach out to the various other organizations, farmers' clubs, farmers' alliance and grange, in such localities as they are doing work along certain lines as prescribed by law, then the officers of the State Board would be enabled through them to reach the farmers.

It seems to me in that way very much more good could be done. I shall not lengthen my remarks, but shall leave with you the suggestion that a committee be appointed.

The CHAIRMAN: The subject is open for general discussion; any one who has anything to say, we would be pleased to hear from now.

MR. McCLELLAN; I hardly see how you could get a closer relation between the farmer and the State Board than you have now. I think about the only law you could ask for would be, like the school law, get a compulsory law, compelling them all to come out.

MR. JAEKEL: I am not in the habit of making any remarks, but I would like to say with regard to this question, that the blame rests with the farmer; it does not rest on the members of the State Board. You can look over the reports that have been issued for years by the Secretary of the State Board of Agriculture, and you will find that the members of the State Board for years and years did the very best they could do. That they are, in fact, in close connection with the farmers I know from my own county. I also know that a great many so-called agricultural societies do not consist wholly of farmers. To investigate that would require a long time, for the reason that there are so few farmers in some of the agricultural societies, at least in my part of the country; but the reports of the Secretary of the State Board, all publications which are issued by the State or from Washington, are advantageously distributed in our county at least. If

there are some failures in other counties to properly distribute, the members of the State Board should not be accused of not doing their duty. They have done it, and if they are hindered by some cause or other, it is not their fault that they are not doing more.

MR. NORTHUP: This matter of discussion does not so much relate to Lackawanna county as it does to other counties, that is, that the agricultural societies of some counties are composed of a class of men who are not farmers. In Lackawanna county we have a little strife on this line. You know that we have what is called the Agricultural Fair up in that county; that is, a horse-trotting arrangement, and a gathering of gamblers, and they have had quite a pull with us. You know there is a law that grants $100 to a county for the purpose of giving agricultural information. They wanted that hundred dollars from our county. There are lawyers and politicians in that organization and there is not much farming about it, but they have a horse-trot and have a good time, and they have that woman that goes around over the country and smashes saloons, to get up an excitement and to draw the crowd. If they had succeeded in getting that hundred dollars, we would not have had any farmers in our organization, but we have stuck to it that it belonged to us as farmers; that we were the original organization in Lackawanna county, and that we should represent ourselves in the State Board of Agriculture, and we have not got a man in the Lackawanna Agricultural Society to-day that is not a farmer; we have not got a member of our committee that is not a farmer, and I am glad to stand up for our county and say we are represented by farmers. If there are any counties in the State of Pennsylvania that are represented by this class of horse-trotters and these clubs, I say there should be some law enacted so that the farmer alone shall be represented, and I believe that the brother is right.

The CHAIRMAN: The Chairman of the Committee on Credentials is prepared to present the report of this committee.

MR. HERR, Chairman of Committee on Credentials: Mr. Chairman, I beg leave to submit the following report of your committee on credentials:

The credentials of the following have been submitted to and examined by your committee and found to be correct; and we recommend that their names be placed upon the roll of members of the State Board of Agriculture:

C. A. Randall, Forest county; S. D. West, Erie county; J. H. Snyder, Luzerne county, and D. A. Knuppenburg, Wyoming county.

J. A. HERR,
W. H. STOUT,
R. F. SCHWARZ,

Report adopted.

A Member: I notice that Mr. Taylor is here from Washington county. I presume he is sent here as a delegate to represent his society at this meeting. I move you, sir, that his name be recorded as a representative from that county.

MR. HERR: We only reported on credentials handed to us; we are ready to receive credentials from that gentleman or any other gentleman at any time during this meeting.

MR. HUTCHISON: Mr. Chairman, I move that this gentleman be admitted as an advisory member of the Board of Agriculture, and that he be granted the privileges of the floor.

The motion having been duly seconded, it was agreed to.

MR. KAHLER: If it is in order, I would suggest that Henry Tippery, of Clarion county, be recognized as an advisory member and that he be granted the privileges of the meeting.

The name of B. F. Kahler, from the Union Agricultural Society was also suggested, as well as the name of Horace Seaman, vice-president of the Lackawanna Agricultural Society was presented, and, on motion, it was agreed that the names of the gentlemen mentioned be placed upon the roll, and that they be admitted to all the privileges of this meeting.

The following names were also presented: W. A. Crawford, of Venango county; Alva Agee, of Ohio; Mr. Hall, of Potter county; Dr. Funk, of Boyertown, and Hon. A. L. Martin, Deputy Secretary of Agriculture, and, on motion, they were added to the roll and granted the privileges of the floor.

Mrs. Martin, Mrs. Clark, Miss Kahler and Mrs. Crawford, on motion, were admitted as honorary members of the Board of Agriculture and were invited to come forward and take front seats.

A Member: We have with us Brother Brodhead, of Susquehanna county, who should be accorded the privileges of the meeting, and I move you, Mr. Chairman, that this be done.

The motion was agreed to.

The CHAIRMAN: The next thing in order is unfinished business. Is there anything left over from the annual meeting that we should dispose of to-day?

The SECRETARY: There is no unfinished business from the other meeting that appeared in the minutes.

MR. CLARK: Mr. Chairman, I move to extend a vote of thanks to our good friend Henry Northup for his fine exhibit of apples and potatoes on the table here.

The motion being duly seconded, it was agreed to.

MR. HUTCHISON: The other day a brother came to my house with some apples and potatoes which were very nice, and after a little time he said, "I don't want you to think that the whole crop is like this." I think perhaps this exhibit here may be a little like that.

The CHAIRMAN: Mr. Martin has a list of persons that he wishes to present.

Whereupon, the following gentlemen were brought forward by Mr. Martin and introduced to the Board:

W. H. Miller, Crawford county; Prof. Wells W. Cooke, Washington, D. C.; A. B. Lehman, Franklin county; Prof. J. M. Hantz, Fayette county; J. T. Campbell, Crawford county; G. B. Waychoff, Greene county; W. H. H. Waltz, Lycoming county; Archie Billings, Erie county; L. W. Lighty, Adams county; Z. T. Cure, Lackawanna county; R. L. Beardslee, Bradford county, and Geo. A. Woodside, Warren county.

MR. STOUT: Mr. Chairman, I listened to Mr. Blyholder's remarks and I think there is something in it, and I was thinking perhaps if it was in order it will be well to have a resolution presented to look into that matter and have it referred to our Legislative Committee so that they may determine whether they think it advisable to recommend any change in the manner in which our State Board is selected.

If it is in order, I move that a committee be appointed to draft and formulate their ideas and present same to our Legislative Committee to report at our January meeting. I don't know, but it seems to me we ought to dispose of it in some shape.

The CHAIRMAN: We are on the question of unfinished business; that would come under the head of new business.

MR. BRODHEAD: I wish to take just a moment to introduce to you my successor in office, Dr. E. E. Tower, of Susquehanna county, and I hope that the members of this Board will extend to him the same courtesies that they have always shown me.

The CHAIRMAN: Is there anything further under the head of unfinished business? If not, we will pass along to new business.

MR. KAHLER: I thought perhaps it would be well enough to appoint a committee as was requested in Brother Blyholder's address, and as I said, formulate some ideas that might be presented to the Legislative Committee. I will venture the assertion that they will be thankfully received. Perhaps it would be a good thing to hand it in to the committee and let it be adopted or rejected. I move that there be a committee of three appointed for that purpose

The CHAIRMAN: I think it ought to come up in the form of a resolution.

MR. KAHLER: Well, it is in the form of a resolution.

The SECRETARY: Mr. Kahler's motion is to appoint a committee to take into consideration the suggestion made by Mr. Blyholder as to whether there is any needed legislation along the lines suggested, which now requires our attention. If the Board thinks there can be some better way devised by which the members of the Board shall be elected, I think that we certainly will welcome it. It is entirely competent to appoint a committee to consider this matter, this committee to confer with the committee on legislation; or if the Board is just as well satisfied, it can be left in the hands of the Legislative Committee. The Legislative Committee is the committee appointed to consider matters of legislation, and the proposed committee will be, in effect, a committee appointed to advise the Legislative Committee. I am not sure but what we are entirely satisfied with the competency of the Legislative Committee, and for this Board to appoint a committee to advise them, perhaps might not be altogether agreeable. If we refer the matter of additional legislation to the Legislative Committee, I think that will cover the whole ground. I second the motion that the subject referred to by Brother Blyholder be referred to the Legislative Committee; I understand that is Brother Kahler's motion.

The motion was agreed to.

The CHAIRMAN: Is there anything further under the head of new business? And are there any other suggestions?

MR. HERR: Mr. Chairman, I am very much pleased with this exhibit that our friend Northup has brought here, and I want to suggest, under the head of new business, the propriety of bringing in samples of this kind from different sections of the State. If I had brought samples of Northern Spy apples, they would not look like that. We might in that way select a whole lot of apples and learn them as true to name. There is a great deficiency in our information along that line, and there are very few persons who can act as a competent committee and judge the different varieties that are exhibited at our fairs. There are very few that know even our ordinary apples, which we ought to know.

I want to ask my friend Mr. Northup to name this apple, and Dr. Funk has brought along a few apples and laid them down there.

The CHAIRMAN: Will you please tell us why your Northern Spys are not like these?

MR. HERR: They are grown in a little different season, a little different climate. Ours are of a deeper color, not perhaps quite so striped but deeper in color.

DR. FUNK: (Referring to his exhibit of apples). Those are the Summer Rambo. The red apple you had in your hand is the apple about which so much has been said. In regard to the Black Ben Davis, the true name is the Regan. You know that there was a controversy in regard to it, some claiming it to be distinct from the Gano apple. Prof. Van Deman decided that there was a distinction. If there is, there is a distinction that would take an expert to distinguish, both in tree growth and in the general appearance of the fruit, in the flavor and everything else. I have a tree and I will defy any man living to pick out one from the other—the Gano and the Black Ben Davis. I obtained these from the experiment station from Ben Wheeler, in charge of the experiment station in Arkansas; that is, the Black Ben Davis or the Regan.

MR. BEARDSLEE: Mr. Chairman, I regret very much that I did not bring along a potato that I saw yesterday morning being unloaded at our nearest station from one of my neighbor's farms. It weighed just even three pounds; another one weighed just two pounds and a half. The potatoes were all large, showing that they were in a very good potato district. I have attended institutes where there has been a very fine exhibit of potatoes, vegetables, fruit and corn—remarkably fine, down in the southern portion of the State, and the effect was excellent, stimulating and elevating. I believe that if it were made a universal rule at these agricultural meetings to present such exhibits, it would be wholesome.

MR. RODGERS: While these large potatoes are interesting as exhibits, they could not be sold; no dealer would buy them because they are too large; they have to sell them by the peck and half-peck and they cannot measure them out.

MR. HERR: I do not mean that the fine specimens of each variety be brought, but that the specimens be really fair, and true to name, as an object lesson and study, not a disappointing study. I do not believe in the modern way of selling fruit trees, exhibiting a picture, which is a monstrosity. I would like to see fair specimens of apples or any other fruit brought in, true to name, and then I would like to see specimens brought in that we want to know about and can't name. A great many have valuable fruit that they cannot name; they do not know what their true name is. If we had such an exhibit and a committee of experienced horticulturists to instruct us, it would add a great deal of valuable information to institute workers and members of the Board, and I move that each person be here-

after requested to bring samples of fruit along for exhibition—fruit and vegetables.

A Member: I am of the same opinion as Brother Herr, and I think that it would also be profitable for the institute workers to invite those with knowledge enough to know the different apples and pears and fruits that we have. There are only about twenty-five apples in Pennsylvania that are of any importance to the grower, no matter how various the ground and climate may be. We have no more than about fifteen different pears, and these brethren can easily get copies from Washington of these apples made from papier mache, as it is called, they cost only a nominal effort and Brother Herr could take them along and show them; it is easily done. Nobody—no expert can go and just name an apple from a tree; that is almost impossible. One apple is grown on the inside of the tree, and will have no color at all; another is grown outside in the sun and it has a beautiful color. You take these two apples from one tree and no expert is able to name with certainty the variety of those two apples taken from the same tree.

The SECRETARY: I second Brother Herr's motion.

DR. FUNK: Fruit raising has been my business for thirty-five or forty years, and for the life of me, if I was called upon to-day to name twenty-five varieties of apples that were worth cultivation in the State of Pennsylvania, I could not do it; I would not know where to get them. When you come to the apples raised in Pennsylvania, and you want an apple that has real true virtue with a tree that is a good, strong, annual grower—annual bearer, one that has beauty, that will attract, and one that has flavor and good bearing qualities, I do not believe I can name you ten apples that are really worth cultivating. The great majority should really be ruled off; should not be on the premium list in our agricultural societies. I claim that by giving premiums we encourage the propagation of these sorts. An exhibit to be brought to the State Fair in competition should be an average that would run uniform, and of medium size, and any fruit that is brought on for exhibition which is knotty, wormy or in any way faulty should be ruled off and not entitled to any premium at all, but we should encourage the kinds of fruit that are of real, true merit. We want an apple like Brother Northup has. The Summer Rambo is a fall apple, and I do not know an apple that will compete with it. It is an excellent apple, as long as it is to be had. We use that exclusively in our family. It is a beautiful apple and a good bearer; why not cultivate them? As a winter apple, any one who wants to plant an apple, plants the Stamen Wine Sap. There is nothing to equal them to-day. The Stamen Wine Sap originated with Dr. Stamen, of Leavenworth, Kansas. It is a strong, vigorous

grower, and under favorable circumstances, an annual bearer. It is an apple which will average larger than the Baldwin, a beautiful red apple—it is red, covered in places with a darker species of red; the whole apple is red, and in quality, I do not know it to be excelled by any. We know that all our markets at the present time, with the exception of Boston, want a red apple.

Now, while we are about it, in regard to the Baldwin, I understand they can raise the Baldwin and the Greening and the Northern Spy, just the same as grown in New York State, but that is in the lower end of the state and it becomes a fall apple. We have got to get apples that are winter apples, that is our only resource. We must plant winter apples that originate in latitude 38 and 9, below 40, and then we have got a true winter apple. By getting these varieties that originate in Northwestern Arkansas, we can get apples that we can keep in any ordinary cave or cellar, that we can hold right on until quite late in the spring, and those are the apples that in the lower end of the State we have to use.

MR. HERR: I would like to ask Dr. Funk if we must not take into consideration apples of different varieties in different parts of the State. I want to say that there is a very great difference in different kinds of apples grown in different parts of the State. There are peculiarities of soil and climate that effect the quality so that it will often vary within less than a mile. I think we ought to take into consideration the apples that prove to us the most profitable in the particular localities where they are grown.

There being no further discussion, the Chairman put the question on Mr. Herr's motion,, to bring apples and vegetables for inspection at all the meetings of the State Board of Agriculture, and the motion was agreed to.

MR. HERR: I move that the Chairman of this meeting appoint a committee of inspection of these apples, to be composed of experienced horticulturists and apple growers to name the varieties of apples that are brought here to be named and to report on the exhibition of fruit and vegetables. I do not want to be one of that committee because I am not sufficiently expert to judge the variety; I ask not to be put on that committee.

The motion having been duly seconded, and the question put, it was agreed to.

There being no further business, the Board adjourned.

N. B. CRITCHFIELD,

Secretary.

LIST OF COUNTY INSTITUTE MANAGERS FOR SEASON OF 1904–5.

County.	Name and Address of Chairman.
Adams,	A. I. Weidner, Arendtsville.
Allegheny,	J. S. Burns, Imperial, R. F. D. No. 1.
Armstrong,	S. S. Blyholder, Neale.
Beaver,	A. L. McKibben, New Sheffield.
Bedford,	S. S. Diehl, Bedford.
Berks,	Howard G. McGowan, Geiger's Mills.
Blair,	H. L. Harvey, Kipple.
Bradford,	E. E. Chubbuck, Rome, R. F. D. No. 16.
Bucks,	Watson T. Davis, Ivyland.
Butler,	W. H. H. Riddle, Butler.
Cambria,	H. J. Krumenacker, Nicktown.
Cameron,	W. H. Howard, Emporium.
Carbon,	J. A. Werner, Weatherly.
Centre,	John A. Woodward, Howard.
Chester,	Dr. M. E. Conard, Westgrove.
Clarion,	S. X. McClellan, Knox.
Clearfield,	J. W. Nelson, Shawville.
Clinton,	Joel A. Herr, Mill Hall, R. F. D.
Columbia,	A. P. Young, Millville.
Crawford,	M. W. Oliver, Conneautville.
Cumberland,	Rev. T. J. Ferguson, Hogestown.
Dauphin,	S. F. Barber, Harrisburg.
Delaware,	J. Milton Lutz, Llanerch.
Elk,	John B. Werner, St. Marys.
Erie,	Archie Billings, Edinboro.
Fayette,	J. M. Hantz, Merrittstown.
Forest,	C. A. Randall, Tionesta.
Franklin,	C. B. Hege, Marion.
Fulton,	R. M. Kendall, McConnellsburg.
Greene,	J. Ewing Bailey, Carmichaels.
Huntingdon,	Geo. G. Hutchison, Warriors' Mark.
Indiana,	S. M. McHenry, Indiana.
Jefferson,	W. L. McCracken, Brookville.
Juniata,	Matthew Rodgers, Mexico.
Lackawanna,	Henry W. Northup, Glenburn.
Lancaster,	W. H. Brosius, Drumore.
Lawrence,	Samuel McCreary, Neshannock Falls.
Lebanon,	Edwin Shuey, Lickdale.
Lehigh,	P. S. Fenstemaker, Allentown.
Luzerne,	J. E. Hildebrandt, Lehman.
Lycoming,	A. J. Kahler, Hughesville.
McKean,	L. W. Howden, Coryville.

County.	Name and Address of Chairman.
Mercer,	W. C. Black, Mercer.
Mifflin,	M. M. Naginey, Milroy.
Monroe,	Randall Bisbing, East Stroudsburg.
Montgomery,	Jason Sexton, North Wales.
Montour,	C. A. Wagner, Ottawa.
Northampton,	Wm. F. Beck, Nazareth.
Northumberland,	J. A. Eshbach, Milton, R. F. D. No. 1.
Perry,	A. T. Holman, Nekoda.
Philadelphia,	Edwin Lonsdale, Wyndmoor.
Pike,	J. H. VanEtten, Milford.
Potter,	Horace H. Hall, Ellisburg.
Schuylkill,	W. H. Stout, Pinegrove.
Snyder,	Charles Miller, Salem.
Somerset,	Jacob S. Miller, Friedens.
Sullivan,	J. K. Bird, Dushore.
Susquehanna,	Dr. E. E. Tower, Hop Bottom.
Tioga,	F. E. Field, Wellsboro.
Union,	J. Newton Glover, Vicksburg.
Venango,	W. A. Crawford, Cooperstown.
Warren,	George A. Woodside, Sugargrove.
Washington,	D. M. Pry, Burgettstown.
Wayne,	W. E. Perham, Niagara.
Westmoreland,	M. N. Clark, Claridge.
Wyoming,	D. A. Knuppenburg, Lake Carey.
York,	B. F. Koller, Shrewsbury.

LIST OF INSTITUTE LECTURERS FOR SEASON OF 1904-5.

Barber, Spencer F., Box 104, Harrisburg, Dauphin county.
Bashore, Dr. Harvey B., West Fairview, Cumberland county.
Beardslee, R. L., Warrenham, Bradford county.
Black, W. C., Mercer, Mercer county.
Bond, M. S., Danville, Montour county.
Brodhead, C. W., Montrose, Susquehanna county.
Brubaker, A. L., Hogestown, Cumberland county.
Burns, J. S., Imperial, R. F. D. No. 1, Allegheny county.
Butz, Prof. George C., State College, Centre county.
Campbell, J. T., Hartstown, Crawford county.
Clark, M. N., Claridge, Westmoreland county.
Conard, Dr. M. E., Westgrove, Chester county.
Cooke, Prof. Wells W., No. 1328 Twelfth street, N. W., Washington, D. C.
Cox, John W., New Wilmington, Lawrence county.
Cure, Z. T., Jermyn, Lackawanna county.
Detrich, Rev. J. D., West Chester, Chester county, R. F. D. No. 12.
Drake, W. M. C., Volant, Lawrence county.
Foight, John G., Export, Westmoreland county.
Funk, Dr. J. H., Boyertown, Berks county.
Hall, Horace H., Ellisburg, Potter county.
Hantz, Prof. J. M., Merrittstown, Fayette county.
Harlan, Hon. A. D., Wenonah, N. J.
Harshberger, J. W., Ph. D., Philadelphia.
Herr, Joel A., Mill Hall, R. F. D., Clinton county.
Hill, W. F., Mont Alto, Franklin county.
Hoover, Hon. E. S., Lancaster, Lancaster county.
Hull, Geo. E., Transfer, R. F. D., Mercer county.
Johnston, J. B., New Wilmington, Lawrence county.
Kahler, Hon. A. J., Hughesville, Lycoming county.
Ledy, J. H., Marion, Franklin county.
Lehman, Amos B., Fayetteville, Franklin county.
Lighty, L. W., East Berlin, Adams county.
McDonald, John T., Delhi, N. Y.
McDowell, Prof. M. S., State College, Centre county.
Menges, Prof. Franklin, York, York county.
Northrop, C. D., Geneva, N. Y.
Northup, Henry W., Glenburn, Lackawanna county.
Orr, T. E., Beaver, Beaver county.
Owens, Wm. G., Lewisburg, Union county.
Patton, James Y., New Castle, Lawrence county.
Peachy, J. H., Belleville, Mifflin county.
Philips, Hon. Thomas J., Atglen, Chester county.
Schock, O. D., Hamburg, Berks county.

Schwarz, Hon. R. F., Analomink, Monroe county.
Seeds, R. S., Birmingham, Huntingdon county.
Stout, W. H., Pinegrove, Schuylkill county.
Stuart, R. R., Callensburg, Clarion county.
Surface, Prof. H. A., Economic Zoologist, Harrisburg.
Thayer, Dr. I. A., New Castle, Lawrence county.
Wagner, F. J., Harrison City, Westmoreland county.
Watts, Prof. R. L., Scalp Level, Cambria county.
Waychoff, G. B., Jefferson, Greene county.
Watts, D. H., Kerrmoor, Clearfield county.
Wallace, Mrs. Mary A. ("Aunt Patience"), Ellwood City, Lawrence county.

RESERVE LIST FOR SPECIAL INSTITUTE WORK.

Armsby, Dr. H. P., State College, Centre county.
Frear, Dr. Wm., State College, Centre county.
Groff, Prof. George G., Lewisburg, Union county.
McWilliams, D. B., Port Royal, Juniata county.
Riddle, W. H. H., Butler, Butler county.
Sexton, Hon. Jason, North Wales, Montgomery county.
Waltz, Samuel W. H., Williamsport, Lycoming county.
Woods, Rev. D. L., Bee Specialist, Muncy, Lycoming county.

STATE OFFICERS.

List of Officials representing the Department of Agriculture, who engage in Institute Work when time from Official Duties will permit.

HON. N. B. CRITCHFIELD, Secretary of Agriculture.
HON. A. L. MARTIN, Deputy Secretary and Director of Institutes.
DR. B. H. WARREN, Dairy and Food Commissioner.
PROF. H. A. SURFACE, Economic Zoologist.
DR. LEONARD PEARSON, State Veterinarian.

ANNUAL MEETING OF INSTITUTE MANAGERS AND LECTURERS.

PROGRAM OF ANNUAL FARMERS' NORMAL INSTITUTE TO BE HELD AT BELLEFONTE AND STATE COLLEGE, PA., OCTOBER 11-14, 1904.

NOTE.—GOVERNOR PENNYPACKER IS EXPECTED TO BE PRESENT AND ADDRESS THE INSTITUTE AT ONE OF THE SESSIONS.

First session convenes in Court House at Bellefonte, Tuesday, October 11, 1904, at 2.30 P. M.

COL. JOHN A. WOODWARD, Howard, Pa., Chairman.

Address of Welcome, by Gen. James A. Beaver, Bellefonte, Pa.

Response, by Hon. A. L. Martin, Director of Institutes.

2.30-3.30. Dr. Wm. Frear, "Soil Improvement."

3.30-4.30. Prof. M. S. McDowell, "Commercial Fertilizers."

4.30-5.00. Round Table, Dr. Wm. Frear.

5.00-5.30. Round Table, Prof. M. S. McDowell.

Tuesday Evening, October 11, 1904.

S. F. BARBER, Harrisburg, Pa., Chairman.

(Session in the Court House at Bellefonte.)

Call to order at 7.30.

Music.

Mrs. Wells W. Cooke, "Domestic Science."

Mrs. Mary A. Wallace, "The Country Home, Its Sanitation and Convenience."

Dr. B. H. Warren, "Importance of Prompt Enforcement of the Pure Food Laws."

Music.

Prof. John Hamilton, "Normal Schools of Agriculture for Institute Workers."

Wednesday Morning, October 12, 1904.

J. S. BURNS, Imperial, R. F. D. No. 1, Pa., Chairman.

(Session at The Pennsylvania State College.)

9.30. Music.

Address of Welcome, by President Geo. W. Atherton, State College, Pa.

9.30-10.30. Section A. Dr. H. P. Armsby, "Animal Nutrition."

Section B. Prof. Wm. A. Buckhout, "Principles of Plant Feeding."

10.30-11.30. Section A. Prof. George C. Watson, "Principles of Animal Breeding."

Section B. Prof. Geo. C. Butz, "Fruit Culture; Large Fruits."

Round Tables.

11.30-12.00. Section A. Prof. H. P. Armsby. Section B. Prof. Wm. A. Buckhout.

12.00-12.30. Section A. Prof. George C. Watson. Section B. Prof. Geo. C. Butz.

Wednesday Afternoon, October 12, 1904.

HOWARD G. McGOWAN, Geiger's Mills, Pa., Chairman.

(Session at State College.)

2.30-3.25. Section A. Dr. I. A. Thayer, "Feeds and Fertility."

Section B. Prof. Geo. C. Butz, "Fruit Culture; Small Fruits."

3.30-4.25. Section A. Mr. L. W. Lighty, "The Farmer's Cow; Her Care."

Section B. Dr. J. H. Funk, "The Pruning of Fruit Trees."

Round Tables.

4.30-5.30. Section A. Dr. I. A. Thayer and Mr. L. W. Lighty.

4.30-5.30. Section B. Prof. Geo. C. Butz and Dr. J. H. Funk.

Wednesday Evening, October 12, 1904.

W. H. H. RIDDLE, Butler, Pa., Chairman.

(Session at Bellefonte.)

7.30. Music. Duet, Mrs. H. A. Surface and Mrs. J. P. Pillsbury.

Prof. W. G. Johnson, Editor of *American Agriculturist*, "The Art of Instruction as a Science."

Music.

Mr. T. D. Harman, Editor of the *National Stockman and Farmer*, "The Influence of a Local Institute Worker."

Thursday Morning, October 13, 1904.

S. X. McCLELLAN, Knox, Pa., Chairman.

(Session at State College.)

9.30-10.30. Section A. Rev. J. D. Detrich, "The Dairy Cow." (Illustrated by sketches).

Section B. Prof. R. L. Watts, "Market Gardening."

10.30-11.30. Section A. Prof. T. I. Mairs, "The Care of Milk and Butter."

Section B. Prof. H. A. Surface, "Insect Preventives."

Round Tables.

11.30-12.25. Section A. Rev. J. D. Detrich and Prof. T. I. Mairs.

Section B. Prof. R. L. Watts and Prof. H. A. Surface.

Thursday Afternoon, October 13, 1904.

JOEL A. HERR, MILL HALL, Pa., Chairman.

(Session at State College).

2.30. Music. Mrs. H. A. Surface.

2.30-3.30. General Session. Dr. Leonard Pearson, "Breeding in Relation to Disease."

3.30-4.30. Section A. Prof. Wells W. Cooke, "The Effects of Feeds on the Quality and Quantity of Milk."

Section B. Mr. Alva Agee, "Potato Culture."

Round Tables.

4.30-5.00. Section A. Prof. Wells W. Cooke.

Section B. Mr. Alva Agee.

5.00-5.30. General Session. Dr. Leonard Pearson.

Thursday Evening, October 13, 1904.

HON. WM. H. BROSIUS, Drumore, Pa., Chairman.

(Session at Bellefonte.)

7.30. Music, Mrs. H. A. Surface.

Dr. D. J. Crosby, of the U. S. Department of Agriculture, "Nature Study and Agriculture in the Public Schools." (Illustrated.)

Prof. H. A. Surface, Pennsylvania Economic Zoologist, "Our Insect Friends." (Illustrated.)

Friday Morning, October 14, 1904.

DR. M. E. CONARD, Westgrove, Pa., Chairman.

(Session at State College.)

Call to order at 9.30. Music.

9.30-10.30. General Session. Prof. Franklin Menges, "Methods of Cultivating Hay and Leguminous Crops."

10.30-11.30. Section A. Mr. J. T. Campbell, "Egg Production."

Section B. Mr. R. D. Barclay, "Bee-Keeping."

Special Round Tables.

11.30-12.00. Section A. Mr. J. T. Campbell.

Section B. Mr. R. D. Barclay.

General Round Table.

12.00-12.30. Prof. Franklin Menges.

Friday Afternoon, October 14, 1904.

M. N. CLARK, Claridge, Pa., Chairman.

(Session at State College, unless otherwise announced.)

2.30. General Session, on "The County and Local Management of Farmers' Institutes."

Hon. Jason Sexton, "The County Chairman."

H. W. Northup, "Institute Committees."

Geo. A. Woodside, "Advertisement of Institutes."

(Five minute discussions, open to all.)

PROCEEDINGS OF THE FARMERS' NORMAL INSTITUTE, HELD IN THE COURT HOUSE, BELLEFONTE AND AT STATE COLLEGE, PA., OCTOBER 11-14, 1904.

Bellefonte, Pa., Tuesday, 2.30 P. M., October 11, 1904.

COL. JOHN A. WOODWARD, Howard, Pa., Chairman.

The CHAIRMAN: In order that we may know whether we are all here or not, the Secretary will call the roll.

The DEPUTY SECRETARY: We will first call the list of County Institute Managers. They will please respond, and the Secretary will check the list in order that we may learn of our attendance.

The following were present:

COUNTY INSTITUTE MANAGERS.

County.	Name and Place.
Adams,	A. I. Weidner, Arendtsville.
Allegheny,	J. S. Burns, Imperial.
Armstrong,	S. S. Blyholder, Neale.
Bedford,	S. S. Diehl, Bedford.
Berks,	Howard G. McGowan, Geiger's Mills.
Blair,	H. L. Harvey, Kipple.
Bradford,	E. E. Chubbuck, Rome.
Bucks,	Watson T. Davis, Ivyland.
Butler,	W. H. H. Riddle, Butler.
Cambria,	H. J. Krumenacker, Nicktown.
Centre,	John A. Woodward, Howard.
Clarion,	S. X. McClellan, Knox.
Clearfield,	J. W. Nelson, Shawville.
Clinton,	Joel A. Herr, Mill Hall.
Cumberland,	Rev. T. J. Ferguson, Hogestown.
Delaware,	J. Milton Lutz, Llanerch.
Elk,	John B. Werner, St. Marys.
Erie,	Archie Billings, Edinboro.
Fayette,	J. M. Hantz, Merrittstown.
Franklin,	C. B. Hege, Marion.
Fulton,	R. M. Kendall, McConnellsburg.
Huntingdon,	Geo. G. Hutchison, Warriors' Mark.
Indiana,	S. M. McHenry, Indiana.
Jefferson,	W. L. McCracken, Brookville.
Juniata,	Matthew Rodgers, Mexico.
Lackawanna,	Henry W. Northup, Glenburn.
Lancaster,	W. H. Brosius, Drumore.

County.	Name and Place.
Lawrence,	Samuel McCreary, Neshannock Falls.
Lehigh,	P. S. Fenstemaker, Allentown.
Luzerne,	J. E. Hildebrandt, Lehman.
Lycoming,	A. J. Kahler, Hughesville.
McKean,	L. W. Howden, Coryville.
Mercer,	W. C. Black, Mercer.
Mifflin,	M. M. Naginey, Milroy.
Monroe,	Randall Bisbing, East Stroudsburg.
Montgomery,	Jason Sexton, North Wales.
Montour,	C. A. Wagner, Ottawa.
Northampton,	Wm F. Beck, Nazareth.
Perry,	A. T. Holman, Nekoda.
Pike,	J. H. VanEtten, Milford.
Potter,	Horace H. Hall, Ellisburg.
Schuylkill,	W. H. Stout, Pinegrove.
Snyder,	Charles Miller, Salem.
Sullivan,	J. K. Bird, Dushore.
Susquehanna,	Dr. E. E. Tower, Hop Bottom.
Union,	J. Newton Glover, Vicksburg.
Venango,	W. A. Crawford, Cooperstown.
Warren,	George A. Woodside, Sugargrove.
Wayne,	W. E. Perham, Niagara.
Westmoreland,	M. N. Clark, Claridge.
Wyoming,	D. A. Knuppenburg, Lake Carey.

The Deputy Secretary then called the roll of Institute Lecturers for the season of 1904-5, with the following result:

INSTITUTE LECTURERS FOR SEASON OF 1904-5.

Beardslee, R. L., Warrenham.
Black, W. C., Mercer.
Bond, M. S., Danville.
Brodhead, C. W., Montrose.
Brubaker, A. L., Hogestown.
Burns, J. S., Imperial, R. F. D. No. 1.
Butz, Prof. George C., State College.
Campbell, J. T., Hartstown.
Clark, M. N., Claridge.
Cooke, Prof. Wells W., No. 1328 Twelfth street, N. W., Washington, D. C.
Cox, John W., New Wilmington.
Cure, Z. T., Jermyn.
Drake, W. M. C., Volant.
Funk, Dr. J. H., Boyertown.
Hall, Horace H., Ellisburg.
Hantz, Prof. J. M., Merrittstown.
Harlan, Hon. A. D., Wenonah, N. J.
Herr, Joel A., Mill Hall.
Hill, W. F., Mont Alto.
Hoover, Hon. E. S., Lancaster.
Hull, Geo. E., Transfer.
Johnston, J. B., New Wilmington.

Kahler, Hon. A. J., Hughesville.
Lehman, Amos B., Fayetteville.
Lighty, L. W., East Berlin.
McDonald, John T., Delhi, N. Y.
McDowell, Prof. M. S., State College.
Menges, Prof. Franklin, York.
Northup, Henry W., Glenburn.
Owens, Wm. G., Lewisburg.
Patton, James Y., New Castle.
Peachy, J. H., Belleville.
Philips, Hon. Thomas J., Atglen.
Schwarz, Hon. R. F., Analomink.
Seeds, R. S., Birmingham.
Stout, W. H., Pinegrove.
Stuart, R. R., Callensburg.
Surface, Prof. H. A., Economic Zoologist, Harrisburg.
Thayer, Dr. I. A., New Castle.
Wagner, F. J., Harrison City.
Watts, Prof. R. L., Scalp Level.
Waychoff, G. B., Jefferson.
Watts, D. H., Kerrmoor.
Wallace, Mrs. Mary A., Ellwood City.

RESERVE LIST FOR SPECIAL INSTITUTE WORK.

Armsby, Dr. H. P., State College.
Frear, Dr. Wm., State College.
Riddle, W. H. H., Butler.
Sexton, Hon. Jason, North Wales.
Waltz, Samuel W. H., Williamsport.
Woods, Rev. D. L., Bee Specialist, Muncy.

STATE OFFICERS.

List of Officials representing the Department of Agriculture, who engage in Institute Work when time from Official Duties will permit.

HON. N. B. CRITCHFIELD, Secretary of Agriculture.
HON. A. L. MARTIN, Deputy Secretary and Director of Institutes.
PROF. H. A. SURFACE, Economic Zoologist.
DR. LEONARD PEARSON, State Veterinarian.

The DEPUTY SECRETARY: There are a number of persons present whose names do not appear on either of these lists. It is proper to state that visitors and delegates are welcome and it is our desire that their names be registered. They are welcome, not only in our meetings, but are invited to take part in the discussions and deliberations. Some few of the county chairmen and others, by reason of sickness and other conditions, have been detained, but other persons are here to represent them, and we desire that they take

their place as members of the organization, and those present whose names have not been called, please raise your hands so that we may get the list correctly recorded.

The following were present:

Name.	Place.
J. A. Farabaugh,	Bradley Junction.
Henry Tippery,	Callensburg.
G. B. White,	Jefferson.
A. M. Cornell,	Columbia Cross Roads.
W. C. Hall,	Karns.
Wm. H. Miller,	Guys Mills.
Geo. Wendel,	St. Marys.
D. S. Taylor,	Raccoon.
G. E. Beaver,	Millerstown.
Horace Seamans,	Factoryville.
Mrs. W. A. Crawford,	Cooperstown.
Mrs. H. J. Krumenacker,	Nicktown.
E. P. Bender,	Carrolltown.
D. F. Fortney,	Bellefonte.
A. D. Harman,	Pittsburg.
E. S. Bayard,	Pittsburg.
Prof. W. G. Johnson,	New York City.
Miss Alma Kahler,	Hughesville.
M. P. Hallowell,	Ivyland.
Mrs. J. Milton Lutz,	Llanerch.
Mrs. M. E. Bell,	Milroy.
Mrs. F. E. Naginey,	Bellefonte.
Mrs. W. L. McCracken,	Brookville.
Mrs. A. L. Martin,	Harrisburg.
Mrs. M. N. Clark,	Claridge.
Mrs. R. S. Seeds,	Birmingham.
Mrs. H. A. Surface,	State College.

The CHAIRMAN: Those who know Bellefonte will know that it is equipped for almost anything that may come up with men or women, and when we were called on to look about for somebody to make the address of welcome, our attention was directed very naturally to our most distinguished and best known citizen, General James A. Beaver, distinguished by having three honorable titles, General, Governor and Judge, and he agreed to take the place and deliver the address; but a sad accident befell him shortly after, and while he has, in a great degree, recovered from that, as you will all be glad to know, he has not recovered sufficiently to get here and perform that duty. A night ride from Philadelphia, which would be necessary, is not deemed prudent for him in the present state of his health. I deem it due to General Beaver, the Department of Agriculture and the citizens of Bellefonte, to make that statement; and then of course we turn to another. We have one with us who is as representative a farmer as is General Beaver, and as representa-

tive a man in a great many directions. The fact that he is president of the biggest bank in town, I know will not affect him disastrously in your opinion. I take great pleasure in presenting to you Colonel James P. Coburn, who is known favorably throughout the State, and who will now deliver the address of welcome.

ADDRESS OF WELCOME.

BY COL. JAMES P. COBURN, *Bellefonte, Pa.*

Mr. Chairman, Ladies and Gentlemen of the State Board of Agriculture and Farmers' Normal Institute of Pennsylvania: It is an unexpected pleasure to meet you here to-day. I am not in training as a speaker, but I know something about farming. I feel that you, in coming here, appreciate fully the fact that the name of the locality is suggestive of its surroundings.

Like Boston, known as the "Hub" in New England, so is Bellefonte, Centre county, known as the "Hub" in Pennsylvania. You are here to-day, gentlemen, within the influence of an institution in which you are interested as well as every citizen in the Commonwealth, in the fact that it is to-day and will be in the future the greatest institution in the State. The work already done is being felt by our people in every corner of this county and of this neighborhood and of these surrounding counties. To-day we have 700 or more boys in school who will go forth armed with knowledge calculated to elevate your profession and mine; calculated to carry forward in an advanced stage the scientific qualifications necessary to make a country great, trained by great teachers schooled in their art and appliances; teachers under the leadership of such a man as Atherton, who is efficient from the ground floor up; teachers with knowledge that brings the lightning from the skies and carries thought through the air.

These sciences and arts are being taught to your sons and your daughters who come from all over the great and noble State to which we belong. This work that is being carried forward, my friends, will elevate every man, woman and child within the influence of this institution and in this Commonwealth, not only in enabling them to labor more intelligently through its educating and liberalizing in-

fluences, but by broadening and strengthening their minds through the processes of scientific thought and scientific application.

This work will go forward and the business that you pursue to-day will become as much a profession, and it is now among those who are trained and disciplined in it, as that of the lawyer or the doctor or the banker or the machinist, or any other man who has followed a line of thought in one direction until he has got the plums that tickle the palate. This, gentlemen, is what we have here, and as we have it here, and you represent a branch of that institution, we welcome you to our midst. You will always be welcome here. We want men in sympathy with the institution who propose to carry forward and elevate the men, women and children of this Commonwealth. The work of 700 intelligent and trained men in scientific lines in any branch, scattered across this broad Continent or over this Commonwealth, is bound to make its mark. Every young man who graduates with honor from that institution will be felt as an uplifting force in the State, and to-day there are more demands for our graduates than there are men to fill them. This indicates a glorious future for us, and a glorious future for you.

I know from my own experience, although I am not a farmer, but I have managed a great many farms, I have collected a great many rents, I have had a great deal to do with a great many tenants, and I have never had a quarrel with one, and I have never had one that failed on any place where I directed him—I do not say this boastingly, but I say that with clean-cut, honorable management, your business is as honorable as that of anybody else, and in the hands of men who are qualified, and know what should be known regarding men in your position and in your toilsome daily struggles for life there should be no trouble, but every man will be your friend and you will be the friend of every one of these men.

One great trouble among farmers is that the landlords, as a rule, are exorbitant; they make hard lines for their people. I always say, if my tenant lives well, I live well. I would rather see my tenant live well; for if he gets along well, he will be better satisfied and have more incentive to do his part. If he gets in a hole, my rule has been, to pull him out. I have one tenant to-day on a property where his father had been a tenant under me for almost fifty years, and his wife took the place after him, and he is there to-day, and has as fine a farm as one could wish, and made it on that property. His brother graduated from one of our finest colleges in the State last year. They talk about the trouble in getting labor on the farm. What do you think I saw there? I saw those boys and their cousins, and they were all on that farm, cutting grain, reaping, mowing, binding and following the reaper. That is the kind of influence you want, and you must get that through your schools; you must get that through

your influence in the home; must get that by teaching your children that it requires scientific knoweldge, a superior knowledge of soils and how to cultivate them, when and how to sow; and whenever you teach that you will go on and find out that there are higher and better rewards for your children on the farm than have ever been secured. I did not intend to say as much as this, but I have tried to discharge the duty imposed upon me as well as I could off-hand, and in closing, I want to say to you all that you are engaged in one of the most important and honorable callings that any man can pursue, and I know that if you will study the problems of the farm, bring enthusiasm to your work, and stick to your business, you will prosper.

The CHAIRMAN: The address of welcome will be responded to by the Deputy Secretary and Director of Institutes, the Hon. A. L. Martin.

The following response was made:

RESPONSE TO ADDRESS OF WELCOME.

By Hon. A. L. Martin, *Deputy Secretary and Director of Farmers' Institutes.*

Mr. Chairman and Friends: It would seem only to remain for me to express for you our hearty appreciation of this very cordial welcome and wholesome address to which we have listened. Indeed, I felt assured before coming to this historic city and county that the latch-string was out and we would be welcome, and this double assurance and welcome, I am quite certain will make every member of this Institute feel at home. Indeed, we are at home anywhere in Pennsylvania, because we control the greatest forces which the Almighty has ever set in action; and why ought we not to be at home anywhere in the State, and especially is this true in this center of the State, the center in more ways than one. We older people in this audience, need but to look back a little, and remember that this county of Centre has been the home of more Governors than any county within the bounds of the State. We go back previous to 1860, half a century, if you please; now I am a pretty young man, but I can remember for half a century in the past. Up here in Howard there lived a Governor of the State of Pennsylvania on the farm now

occupied by our worthy Chairman; indeed, he happened to marry one of that family, and is living on that historic farm—Gov. Packer—so that before 1860 this county gave to the State an honored Governor. Then just following that the war times came on, and I do not need to mention the name of our great war governor to you—Andrew Gregg Curtin—elected to direct the affairs of this great State during that trying period.

We older men have not forgotten those days. We remember that warm-hearted, earnest, energetic man. His home was in this city; his family and kindred still live here. Then after him, as the next Governor, came the gentleman who is placed upon our program for this address of welcome, the soldier, the General, I should say, the Governor and the Jurist, three in one, bearing a trinity of honors. Still later, to honor the county and honor the State, and honor the Nation, came another, and the last that I shall name of these honored governors, Daniel Hartman Hastings, recently deceased, the clear-headed, brilliant Hastings. So I say, we of Pennsylvania ought to feel honored to meet in Centre county because it is and was the home of so many great and good men.

There is another reason why we ought to feel at home here in Centre county; this was referred to in the address of welcome. Here in this county is established and has been organized for many years, the School of Agriculture, treating and giving lessons upon the great problems with which you and I have to deal with upon our farms all over this great State. This School of Agriculture affords you and I and our families, so far as we can improve it, the opportunity of attaining a knowledge of the greatest benefit to our occupation. My fellow-farmers, have you ever stopped to think just what botany and chemistry and a knowledge of these scientific questions as they have been developed within the last ten or twelve years, has done for agriculture? How little we knew fifteen years ago of this soil we cultivate! We regarded it as almost dead, inert matter. Chemistry has taught us that it is alive, living, moving matter; it deals with the principles of plant life and animal life, and all vegetation. The question of bacteria and questions of all these things relative to the soil, chemistry has developed for the farmer. These schools have developed them, and we must draw from them the knowledge we require which it would be impossible for the farmer out on his farm pursuing his labors there, to acquire from any other source; hence we are at home here in Centre county, because we are pushed right up against that great school that is doing more and will do more for the farmer than any other school that we are likely to have, unless the day should come that in these country schools out all over Pennsylvania there should be established a system of teaching the elements and principles of agriculture to our little boys and

girls, thus laying the foundation for this broader culture and development to be obtained at this College of Agriculture.

Now, my friends, it is not fitting that I should continue this talk. We have assembled for a very important purpose and upon your shoulders and mine rest a responsibility, an obligation to duty. The State government has established within our bounds a Department of Agriculture. It has placed within that Department a Division of Farmers' Institutes, and because of that act we are assembled to-day to devote a week to the study of the great problems associated with agriculture; and when I say agriculture, I mean every division and department of it embracing the soil, the vegetable, the fruit, the animal and all the material things with which we have to deal, and handle upon these farms of ours.

The program is in your hands. You have no doubt studied it somewhat and our intention is to carry it out just as far as circumstances will permit. It is intended that we shall all become one school, studying these questions in order that, in about six weeks, when as institute instructors we go up and down the valleys and through the counties of the great Commonwealth of Pennsylvania, our voices will be as the voice of one man, proclaiming the lessons which experience and science and practice have revealed to us are true and good, and thus holding up the standard of agriculture and making it not only as honored as any other occupation, but making it, as by right it should be, the most honored of all occupations, because those engaged in it have the best equipped minds, the best equipped physical conditions; they breathe the pure air of heaven and turn their faces to every wind that blows, and every condition that meets them, as men equipped to carry on this great occupation to the finishing point; and after all we shall have done, my friends, we will only have begun to delve a little into the mysteries of these great laws with which we have to do. My friends, these laws are as high as the Heaven above us; they are as deep as the fathoms of the earth beneath us, because they have been planted by a Divine Mind, and we are called to bring these laws into submission, and have dominion over them. This gives us only a slight conception of the work we have in hand this week, and without a continuation of these remarks, which are intended to be expressive of the gratitude we feel as a Department of Agriculture to the men and women who have taken up this work throughout the State, I must hasten to a conclusion. Your presence here to-day in such numbers manifests the lively interest you have in the great work, and so, without further remarks, we shall at once proceed to enter upon the program. Our intention is to hold the day meetings as far as possible at State College. Announcement will be made of the time at which the train leaves for and returns from State College.

We have prepared tablets and pencils, and we know we shall not be disappointed in this, that all lecturers and county chairmen; as far as possible, will go into these classes and note the points and the facts in the lessons. You know our memories are just a little treacherous sometimes, and in that way you can carry home the information that we are here to obtain, so that when you go to work in the different counties with your assignments, whatever of importance is taught here, you will have that not only in your minds, but have the written record to refer to; hence these tablets will be distributed so that you may take notes. We have question blanks here, and Mr. Hull, of Mercer county, Mr. Crawford, of Venango, and Mr. Northup, of Lackawanna, will have charge of the Question Box. These gentlemen will take charge of the blanks and will distribute them during the sessions.

I thank you, gentlemen, for the opportunity to make this response and for your presence in such numbers at this time.

The CHAIRMAN: The audience cannot regret more than I do that I am unable to introduce Dr. Frear at this time. He is detained by his duties in a distant part of the State, and has been unable to reach here. He has promised that he will be with us to-morrow morning at the session in State College, therefore, we will have to pass the Doctor's name and the subject, and will introduce to you Prof. M. S. McDowell, of the State College, who will address us upon "Commercial Fertilizers."

H. H. Hall, of Potter county, at the suggestion of Secretary Critchfield, sang a song; he said his subject was agriculture, but with more precise description, it might have been called "Maria Shelling the Green Peas."

PROF. McDOWELL: Mr. Chairman: I regret quite as much as yourself that Dr. Frear is not able to be present, because I would much rather he should break the ice, if I may use the term, than myself. In opening the discussion, I desire to say that so far as my own remarks are concerned, much of the material that you may get, probably many of you have heard from me before. There are certain fundamental facts that it is necessary to emphasize and bring out in order to lead up to a better understanding of one or two further points which I may try to speak of.

Prof. McDowell then read the following paper:

COMMERCIAL FERTILIZERS.

By Prof. M. S. McDowell, *State College, Pa.*

The use of commercial fertilizers as well as the development of the entire field of agricultural chemistry, has been a matter of entirely modern growth. The development which has taken place in this field of scientific research has occurred within the last fifty years. The investigations and conclusions of the noted German chemist, Justus von Liebig, furnished the foundation upon which the present superstructure of our knowledge has been reared. The records show that bones and phosphatic marls were used centuries ago to produce better crops, but they were used without knowledge of their action, but simply as a result of accident or observation. The present theory of the relation of plants and plant food has made it possible to place this question of fertilization upon a more rational basis. The principle facts upon which our knowledge of the whole field of agricultural chemistry is based are briefly stated about as follows: Chemistry is that branch of natural science which treats of the composition of matter and the changes which occur as a result of alteration of the molecules. Chemistry recognizes seventy some different elements. A chemical element is any substance which can not by any known means be separated into two or more different kinds of matter. Of the total number of elements known to chemistry, however, only fourteen are required for the production of plants. These fourteen are carbon, hydrogen, oxygen, nitrogen, potassium, phosphorus, calcium, iron, sulphur, magnesium, chlorin, sodium, silicon and manganese. We are already familiar with the fact that as far as the supply of these materials for use of the plant is concerned, eleven of them are always present in suitable condition. The three which are often found to be deficient are nitrogen, phosphorus and potassium, or as we are more familiar with them—nitrogen, phosphoric acid and potash. In the present discussion we will include only one of these fertilizing elements—phosphoric acid—discuss its sources, forms and some phases of its uses. Phosphoric acid, or rather the element phosphorus—is not only essential to plant growth but the functions it performs in the plant are quite varied. Phosphorus is found in large quantities in yeast cells, in the form-

ing seeds, in the muscles of animals, and in all cases where special demand for chemical activity is made. It is in the seed especially that the influence of fertilization with phosphoric acid is most apparent. Phosphoric acid is generally found combined with lime, forming calcium phosphate or so-called bone phosphate of lime. It is found in large quantities in several minerals and constitutes about 85 per cent. of the ash of bones. The chief raw materials which furnish it for the manufacture of commercial fertilizers are bone, bone black, phosphatic guanos, basic slag and rock phosphates. Bones consist of two different kinds of material in addition to water. The larger part consists of phosphate of lime, the other portion being ossein or gelatine and fat. As bones come into the market for use as fertilizers they vary greatly in composition according to the manner in which they have been treated. Raw bone refers to bones which have been ground in the raw state without previous treatment. Raw bone contains 4.5 per cent. nitrogen and about 25 per cent. phosphoric acid. They contain in this condition considerable fat which is objectionable as it increases the difficulty of grinding, and in addition to this greatly retards the decomposition of the bone in the soil. Raw bone is usually treated under pressure with steam to effect the removal of the ossein or nitrogenous material and fat. While the ossein contains nitrogen and its removal thus diminishes the amount of nitrogen in the bone, the gelatinous material is more valuable for the making of gelatine and glue. The fat is utilized for making soap. Steamed bone contains from 28 to 30 per cent. of phosphoric acid and about 2 per cent. of nitrogen. Its composition will of course vary with the extent of steaming. The greater the amount of gelatinous material removed the less nitrogen and more phosphoric acid it will contain and vice versa. Bone ash is the name applied to bones which have been burned in the open air. Bone black, more often spoken of as animal charcoal, represents bones which have been charred in vessels from which the air has been excluded. The moisture fat and nitrogenous materials are thus driven off, the residue consisting chiefly of insoluble tri-calcium phosphate and charcoal. The presence of the latter renders the phosphoric acid quite unavoidable and although bone black contains ordinarily over thirty per cent. of phosphoric acid, it is not valuable in this form as a fertilizer.

Dissolved bone black is made from bone black by treatment with sulphuric acid in the same manner that dissolved rock is manufactured from rock phosphate and contains from 15 to 17 per cent. of available phosphoric acid.

Guanos: The natural guanos consist chiefly of the deposits of sea fowls deposited in rainless regions. Chief among these may be mentioned Peruvian Guano. It is to the nitrogen compounds that guanos

of this class owe their chief value, although the phosphoric acid they contain, 12 to 15 per cent., is also of very considerable value. The supply of nitrogenous guano is practically exhausted so that what appears on the market under this name now is mostly of an inferior quality or is what is known as Rectified Guano.

Phosphatic Guano: There are certain islands in the Pacific Ocean and elsewhere exposed to abundant rains where the dung of sea fowls has accumulated under such conditions that all the readily soluble matter has been washed away, phosphate of lime remaining. The supply of the best of these phosphate guanos has, however, also been practically exhausted.

Rectified Phosphate, is the name used to designate some of the inferior forms of guano which have been treated with sulphic acid to render the phosphates soluble and have had nitrogen added in the form of sulphate of ammonia.

Basic Slag: Odorless phosphate or slag phosphate are names commonly applied to this material. It is a by-product from the manufacture of iron and steel by a process invented by Jacob Reese, of Pennsylvania. The phosphoric acid is present as tetra-calcium phosphate and is insoluble in water and only partially soluble in ammonia citrate. When applied to the soil, however, it seems to have a favorable effect and is used, especially in Germany, to quite an extent as a fertilizer. It has not been used to a great extent in this country, but in many instances has shown good results. The ordinary methods of fertilizer analysis show it to contain from 15 to 20 per cent. of phosphoric acid, 5 or 6 of which are soluble in ammonia citrate.

Phosphate Rock: The deposits of phosphate of lime found in South Carolina, Florida and Tennessee, are the chief sources of phosphates for fertiiizer manufacturing purposes. South Carolina phosphate was discovered in 1844, but the first artificial fertilizing material was not prepared from this source until about 1868. These phosphates occur or are known under two separate heads, as Land Rock and River Rock, depending upon the location in which they are found. They vary somewhat in their physical properties, but their chemical composition is about the same. The land rock is somewhat lighter in color—yellow or gray—and occur in nodules. These nodules are easily broken, and ground to a fine powder, they constitute so-called "floats." While the term, rock, is applied to them and while they resemble rock in most particulars, they are the result of deposits of land and marine animals. South Carolina rock contains from 25 to 28 per cent. of phosphoric acid.

Florida Phosphate: These deposits were discovered in 1881; but it was not until 1888, that their presence was generally known and that shipments were made from this field. The composition of the

Florida phosphates is not greatly different from those of South Carolina. They contain more iron and alumina phosphate, and run smaller in size, hence they are often designated as pebble phosphate. There are both land and river deposits of these pebble phosphates as well as land rock deposits.

Tennessee Phosphate: In 1894, phosphate deposits were discovered in Tennessee, and these are being used to a considerable extent today. In case of these deposits, they are not found in pebble, nodule or boulder form as in South Carolina and Florida, but occur in veins and pockets. Their composition is also somewhat variable.

Apatite is a form of phosphate of lime found in New York State and in Canada. From the fact, however, that it is very hard and, therefore, difficult to grind; it is not used for manufacturing purposes except to a very limited extent. It sometimes contains as high as 40 per cent. of phosphoric acid.

Coprolites and Phosphorites, sometimes spoken of as sources of phosphoric acid, are found in Europe, but are not used in this country.

PHOSPHORUS.

The element, phosphorus, does not occur in the free state, but is found associated with other elements in the form of phosphates. Phosphoric acid is made up of the elements, phosphorus, oxygen and hydrogen. Free phosphoric acid does not occur in nature, but when the hydrogen of this acid is replaced by a base, as for instance, with lime, iron or alumina, we have a lime, iron or alumina phosphate. The raw materials, which furnish phosphorus for commercial fertilizers, contain it usually in the form of phosphate of lime or tricalcium phosphate. In this condition the phosphate is insoluble in water and in the slightly acid soil water. That is to say, they are not in a condition in which they will be of immediate use to growing crops.

Liebig, reference to whom has already been made, was the first to suggest the treatment of calcium phosphates with sulphuric acid in order to render the latter easily soluble in water. This was about 1840, and the manufacture of artificial fertilizers dates from about this time. The phosphoric acid is present in bones in South Carolina, Florida and Tennessee rock in the same form, that is, as tri calcium phosphate, 168 parts lime being united with 144 parts of phosphoric acid to form 310 parts of phosphate of lime, or as manufacturers sometimes speak of it, bone phosphate of lime. Now, when these insoluble phosphates are treated with sulphuric acid, a change is brought about in the relation of these elements to each other. The sulphuric acid unites with a part of the lime to form sulphate of lime

or gypsum. The remainder of the lime and phosphoric acid unites with water to form one lime calcium phosphate. This reaction may be represented by the following formula: $Ca^3 (Po^4)^2 + 2H^2 So^4 = {}^2Cas\ o^4 + Ca\ H^4 (Po^4)^2$

312 parts tri-calcium phosphate + 196 parts sulphuric acid=272 parts gypsum + 236 parts mono-calcium phosphate.

This mono-calcium phosphate, or one lime phosphate, is the so-called soluble phosphoric acid of the trade.

Perfect reaction, however, seldom occurs. Less sulphuric acid is used than would be required to convert all the phosphoric acid into soluble phosphate. Reaction takes place in part as above and in part as follows:

$Ca^3 (Po^4)^2 + H^9 So^4 = Cas\ o^4 + Ca^2 H^2 (Po^4)^2$
312 parts + 98 parts=136 parts + 274 parts.

This last product is di-calcium phosphate or the so-called reverted phosphate acid. In addition to this, a small part of the original lime phosphate usually remains unacted upon, forming the insoluble phosphoric of the manufactured product. The manufacture of dissolved bone, dissolved bone black and dissolved rock is dependent upon the same reactions. The advantage occurring from this treatment is the bringing of the phosphoric acid into a readily available condition so that it can be immediately used by the plant when applied to the soil. So far as its use by the plant is concerned, the reverted form is as available as that which is soluble in water, the only advantage of the latter being the even and uniform distribution in the soil and the fineness of subdivision. When we come to consider the proper and most economical use of the phosphates, there are many conditions which must be taken into consideration. It is a well established fact that plants absorb material from the soil in solution. The natural supposition would, therefore, be that the phosphoric acid should be applied in a readily soluble form, and there are a great many cases where this is correct. A young plant just starting its root system might utilize to good advantage phosphoric acid in a soluble form. It would be enabled to get a strong healthy start and in the end work up the natural plant food material in the soil to better advantage. Not only this, the object to be attained must be considered. The trucker aims at quick returns and must be guided by different considerations than one engaged in some other line of farming.

For the present, however, we will confine ourselves to a consideration of the use of insoluble phosphoric acid, citing some of the conclusions arrived at by those who have conducted experiments in this particular field. In considering the advisability of using insoluble

phosphates, the various conditions affecting its availability should be taken into consideration. The character and composition of the soil, the amount of organic matter in the soil, the kind of plants to be grown, the source and general character of the phosphate itself are factors bearing upon this point. The amount of organic matter or humus in the soil will materially affect the degree to which these insoluble phosphates can be utilized. In the rotting of vegetable matter or manure in the soil, carbon dioxide is produced in large quantities. This forms a weak acid with water and is capable of considerable dissolving action. Not only this but in the process of decay certain organic acids are formed, which have a direct dissolving effect upon insoluble phosphates in exactly the same manner, though not to the same extent, as the sulphuric acid which is used in connection with the manufacture of the super-phosphates from rock phosphate. It is true that certain plants have greater power for working up insoluble plant food material than other plants. Different classes of plants vary widely in their ability to dissolve mineral plant food. In general, it may be said, that the cereals and grass possess limited power in this direction, the leguminous plants to a considerably increased degree and root crops, especially turnips, quite readily. The source and general character of the phosphates themselves will influence the degree of their availability, while the phosphoric acid, as has already been noted, is present in bone and in phosphate rock in the same condition—that is as tri-calcium phosphate, or, as we say, in an insoluble form, the phosphoric acid of bone is much more easily available than that of the rock. This is due to the fact that in the bone the phosphate is associated with more or less organic matter, the decaying of which aids very materially in accomplishing the solubility of the phosphoric acid of the bone. In the rock the phosphates are associated almost entirely with mineral matter there being nothing present to aid decomposition. The degree of fineness will also affect its availability.

The Rhode Island Experiment Station gives in their report of 1897, partial results of an experiment designed, if possible, to ascertain the most economical form in which to apply phosphoric acid. All the plots in the experiment received like amounts of potash and nitrogen and the same money value of phosphoric acid in its various forms with the exception of two check plots which, of course, received no phosphoric acid. The plots were seeded to grass in 1895. The insoluble phosphates—fine ground bone, slag, phosphate and floats—were applied as a full ration at that time and each spring for three years each received a one-third dressing of nitrate of soda and potash and also a one-third ration of soluble phosphates.

By a full ration, is meant at the rate of 600 pounds per acre of dissolved bone black and as many pounds of the other forms of phos-

phate as the cost of that would purchase. Application was made in this way on the assumption that the insoluble phosphates, being much less available, would remain in the soil through the period of three years while the soluble, more readily available material, should be supplied from year to year as required. At the end of three years all the plots would have then received a like money value of fertilizer. At the time this report was made the last one-third of the ration of soluble phosphates had not yet been applied so that the soluble and insoluble forms of phosphoric acid were not on the same basis, but the summary given of the results at that time was that "the three insoluble phosphates, fine ground bone, floats and slag maintained the lead and that while there was one more dressing of soluble phosphates to be given, the lead held by the insoluble forms would doubtless even then give the latter the advantage."

The Maine Station in their report of 1891 reports a trial of different forms of phosphoric acid extending through a period of 6 years. They came to the conclusion that dissolved phosphates were more efficacious than the insoluble forms. In the field trial in which three crops of oats and one of hay and peas were grown, insoluble phosphoric acid was second in hay and third in oats and peas.

The most extended and systematic experiments along this line, however, had been conducted at the Maryland and Pennsylvania Stations. Bulletin No. 68, of the Maryland Experiment Station gives a detailed report of the former. A summary of the principal facts relating to this experiment may also be found in Bulletin No. 94, of the Pennsylvania Department of Agriculture. The average total results show that insoluble phosphoric acid yields a greater number of pounds of both grain and straw than phosphates in the soluble and reverted form, and the yield was not only greater but the cost was only about one-half as much. The experiments in Pennsylvania were planned by Dr. W. H. Jordan, now Director of the Experiment Station at Geneva, N. Y., and a full discussion of the results covering a period of 12 years during which the experiment was in progress may be found in the station report for 1895. The soil is a limestone clay formed from the decomposition of the surrounding and underlying rock which is largely magnesian limestone. It has the general appearance of a clayey loam. In the beginning of the experiment a given weight of each of the different fertilizers was applied, the plan being to apply the same amount of phosphoric acid in the four different forms, but as the composition varied considerably, a chemical analysis was made in the later years of the experiment and a definite amount of the valuable ingredients applied per acre. The rotation used was the one common to this section, wheat, grass, corn and oats. The plots were 1-20 of an acre in area and the results are

stated in terms of so much per acre, all of the plots, except of course the nothing plot, received an application of potash and nitrogen at the rate of 200 lbs. of muriate of potash and 240 lbs. sulphate of ammonia per acre; these amounts corresponding to 100 lbs. of actual potash and 47 lbs. of nitrogen per acre. The various forms of phosphoric acid were supplied as follows: Soluble, from dissolved bone black, reverted from dissolved bone black, treated 12 hours previous to using, with an equal weight of quick lime; insoluble phosphoric acid from ground bone and South Carolina rock. The bone black in both cases being supplied at the rate of 200 lbs. per acre, or 32 lbs. of phosphoric acid and the ground bone and South Carolina rock at the rate of 150 lbs. to the acre, corresponding to 40 lbs. of phosphoric acid. The following table shows the average yield of wheat, grass, corn and oats through the entire period of 12 years during which the experiment was in progress:

TABLE A.

Average Yield of Wheat, 1884-1888-1892.

	Grain—bushels.	Straw—pounds.	Total—pounds.
Soluble P_2O_5, dissolved bone black,	28.23	3,014	4,708
Reverted P_2O_5, dissolved bone black,	29.90	3,208	5,002
Insoluble P_2O_5, ground bone,	31.58	3,339	5,234
Insoluble P_2O_5, S. C. rock,	31.56	3,338	5,232
No phosphoric acid,	30.57	2,798	4,632
Nothing,	22.52	1,966	3,317

Average Yield of Grass, 1885-89-93.

	Total—pounds.
Soluble P_2O_5, dissolved bone black,	3,167
Reverted P_2O_5, dissolved bone black,	3,300
Insoluble P_2O_5, ground bone,	3,365
Insoluble P_2O_5, S. C. rock,	3,133
No phosphoric acid,	2,492
Nothing,	2,048

Average Yield of Corn, 1886-90-94.

	Ears—bushels.	Stover—pounds.	Total—pounds.
Soluble P_2O_5, dissolved bone black,	48.86	1,942	5,362
Reverted P_2O_5, dissolved bone black,	49.60	1,937	5,409
Insoluble P_2O_5, ground bone,	51.96	2,073	5,710
Insoluble P_2O_5, S. C. rock,	47.64	1,908	5,243
No phosphoric acid,	40.68	1,667	4,515
Nothing,	38.07	1,027	3,342

Average Yield of Oats, 1887-91-95.

	Grain—bushels.	Straw—pounds.	Total—pounds.
Soluble P_2O_5, dissolved bone black,	43.75	1,337	2,737
Reverted P_2O_5, dissolved bone black,	47.10	1,326	2,833
Insoluble P_2O_5, ground bone,	49.39	1,595	3,175
Insoluble P_2O_5, S. C. rock,	48.24	1,557	3,101
No phosphoric acid,	45.54	1,217	2,674
Nothing,	38.81	1,035	2,337

Wheat: The average for the three years shows the greatest yield to have been given by insoluble phosphoric acid from ground bone, 31.58 bushels of grain and 3,339 pounds of straw. Insoluble phosphoric acid in the form of dissolved rock gave practically as good results.

Grass: In case of grass, taking the average for three years, the largest yield is 3,365 lbs., is given by insoluble phosphoric acid from ground bone, followed by reverted phosphoric acid. Insoluble phosphoric acid in the form of South Carolina rock gave the smallest yield, 3,133 lbs., but the difference was not sufficient, however, to pay for the extra cost of the soluble phosphoric acid. Although there was no fertilizer applied directly to the grass there was a larger increase due to the effect of the fertilizer applied to the wheat than there was in the case of the wheat—the crop that received the application of the fertilizer.

Corn: The largest yield of grain in case of corn, 51.96 bushels, as well as stover was from insoluble phosphoric acid ground bone. Insoluble phosphoric acid, South Carolina rock, gave the smallest yield of grain and stover although, as in case of grass, the difference was not large enough to pay for the extra cost of the fertilizer.

Oats: The largest yield of oats was from insoluble phosphoric acid ground bone followed very closely by South Carolina rock.

In order to reduce these results to a common denomination, a money value has been placed upon all the crops grown and upon the fertilizer used. The prices selected for hay and grain are those reported by the statistician of the U. S. Department of Agriculture, as the average selling price in Pennsylvania.

In case of straw and stover, the approximate selling prices in the community are taken. In computing the values of the various crops the average price for the entire period of 12 years has been used. In case of the fertilizers, the average valuation given the various fertilizer ingredients during this period have been used. The following table gives a summary of these values:

TABLE B.

	Value of crops for 12 years.	Value of fertilizers for 12 years.	Net gain or loss due to fertilizers.	Gain due to phosphoric acid.
Soluble phosphoric acid,	294.22	97.68	—18.77	5.74
Reverted phosphoric acid,	306.81	91.72	—.22	24.29
Insoluble phosphoric acid, ground bone,	322.07	97.32	+9.44	33.95
Insoluble phosphoric acid, S. C. rock,	308.54	88.31	+4.91	29.42
No phosphoric acid,	274.08	83.28	—24.51	.....
Nothing,	215.31	.....	.....	.....

Taking the average for the 12 years, insoluble phosphoric acid from ground bone gave a gain of 79 cents per year, and insoluble phosphoric acid from South Carolina rock a gain of 41 cents. Soluble phosphoric acid showed a loss of $1.56 per year, reverted phosphoric acid a loss of 43 cents, and the nitrogen and potash plots a loss of $2.04 per year.

A study of the results of these different experiments, all pointing in the same general direction, would seem to indicate a necessity for revising our teaching somewhat with reference to the use of insoluble phosphoric acid. It would not be proper to advise their use generally in an untreated form, but it is a matter upon which it might pay the individual to experiment. It should be borne in mind, in this matter of the most economical method of fertilization, that one must be guided by the object sought or the particular kind of farming in which he is engaged so that a system suitable for one may not be for another.

The CHAIRMAN: The Round Table will be taken up immediately.

The DEPUTY SECRETARY: These questions we expect to have published. Where you give oral questions, give them as concisely as circumstances will permit. Keep in mind that it is our intention to publish these questions and answers.

A Member: Mr. Chairman, I would ask if the questions must necessarily be pertinent to the subject discussed.

The DEPUTY SECRETARY: Certainly; only questions pertinent to the subject under discussion.

ROUND TABLE.

(Conducted by Prof. McDowell.)

A Member: Is there any difference in phosphoric acid from basket-slaked bone or rock?

PROF. McDOWELL: Of course, as far as phosphoric acid is concerned, as a chemical element, it is phosphoric acid; it doesn't matter at all from what source it is derived. Phosphoric acid is contained, as I said a little while ago, in different forms in these various forms of phosphate; it is contained in exactly the same form in the bone or in the rock.

A Member: What proportion of phosphoric acid is there in roasted bone?

PROF. McDOWELL: That depends upon the condition of the roasting; it would probably contain as high as thirty or even more per cent. The roasted bone would probably contain a larger percentage, depending upon the extent to which that process had been carried on.

A Member: I ask these questions because I can produce it from a mill that I have, and it is a question with me whether I can afford to buy it in preference to buying the ground bone, when I have a bone at home at a nominal price.

PROF. McDOWELL: In roasting the bone you get rid of that material I speak of that makes it difficult to grind. The only thing is, if you roast it to too great an extent, there is danger of rendering it more insoluble than in the raw state.

A Member: What is the origin or source of phosphoric acid?

PROF. McDOWELL: I don't know that I understand just what is meant by that question; the original form was probably in the form of bone. Is that what you had reference to?

A Member: Is there any difference in the value of bone dissolved with sulphuric acid or with acid from gas works?

PROF. McDOWELL: Well, of course, any acid will have the same dissolving effect upon bone. There are other acids which will produce the same effect, bring about the same result as sulphuric acid, but sulphuric acid is the one that is most convenient to use in practice.

A Member: Will a soil overrun with sorrel act as a solvent on fertilizers that may be present?

PROF. McDOWELL: Soil overrun with sorrel—well, sorrel is sometimes an indication of a sour condition; that is not necessarily so. If the soil is acid, of course that acid will have a tendency to act upon any insoluble material in the soil.

A Member: Does it make any difference to plants from what source the different elements of plant food in the commercial fertilizer applied to the soil is derived.

PROF. McDOWELL: Yes, it does sometimes. Take potash, for instance, in the form of muriate. It is claimed that potash in the form of muriate is beneficial in some cases. Wheat seems to give somewhat better results when nitrogen is applied in the form of nitrate of soda, so that plants seem to show a difference in their preference for the source from which their food is derived, just as we do sometimes.

A Member: Is a mixture of equal parts of gypsum and float of special value as a deodorizer, and what is its value as a fertilizer?

PROF. McDOWELL: Float, of course, has not really any value as a deodorizer or as an absorbent in the stable; I take it that is what is meant there by deodorizer. It may be regarded possibly as a preservative rather than as a deodorizer, that is to say, for use in the stable to prevent the loss of ammonia. Of course sulphate of lime or gypsum or dissolved South Carolina phosphate has the power of absorbing these things.

A Member: How would you undertake to advise a farmer which to use, the soluble or insoluble, not knowing the condition of the soil?

PROF. McDOWELL: I am going to ask Mr. Agee to answer that question.

MR. AGEE: I could not advise it. I don't believe that any one could safely advise it. We have got a good deal of soil in Ohio and Western Pennsylvania in which I believe the use of acid phosphate is strictly dangerous. If you will go with me over the experimental plot at the West Station Farm to-day, you will find there that every field that the acid phosphate—that the acidulated fertilizer has touched—that there their clover is unhealthy or absent. For that reason I have learned to advise no man to use the acid phosphate

without knowing that there is enough lime in that ground to correct the acidity.

I would just like to add one word if I may have the time. We want to go over the State, all teaching the same lesson. I believe we ought to gather up in one minute this thought, that where a man has a soil full of humus or decayed vegetation on which some phosphoric acid is needed, there we may very safely advise him to use the float or, better still, to use basket slaked or clear-cut rock with animal bone. I believe you will find it will give good results. But where you havn't that material, then a soluble series of phosphoric acid, and if you have made use of acidulated phosphate, you must apply some lime or the day will come when clover will quit. It has quit on tens of thousands of acres in Pennsylvania and on more acres in Ohio, and the best service that can be done for the farmer to-day who needs money, is to teach him that a little bit of lime applied to soils that have received acid phosphates, are necessary to bring back the clover.

A Member: Can seed corn be grown by the use of commercial fertilizers when soil is deficient in vegetable or organic matter or humus?

PROF. McDOWELL: I will refer that question to Mr. Seeds.

MR. SEEDS: I want to say one thing. A great problem comes up in my mind when I hear this talk of professors from the State College and then realize that there are seven mil'ions of dollars spent in Pennsylvania annually for fertilizers. The question arises with me, how much of that money is wasted? When a man has corn and corn fodder and timothy hay to feed a cow, he will try bran in different proportions. I would like to go out over the State of Pennsylvania and be able to give the farmers some guide by which they can buy fertilizers. I believe that out of the seven millions of dollars invested in commercial fertilizers, that half of it is wasted. Of course we don't get down to the bottom to ascertain the balance of this ration. As Brother Agee has answered that question, you go on and use acid phosphate and you get a soil so depleted of humus and decayed vegetable matter that it is not possible, as Brother Agee has said, for it to produce clover.

Illinois has begun the work and taken soil from different parts of the state in order to test this question, and they are going to determine how much phosphoric acid and how much nitrogen should be used on the different soils. I propose to get that from Illinois and make use of it. I am convinced that the plant that grows out of the ground needs a balanced ration just the same as the cow, or the hen that is on the nest or the horse that is on the track.

MR. AGEE: I want to say one more word now because I think I have left a wrong impression. There is land in Pennsylvania, some right here on your State College farm, that can be treated with acidulated fertilizer safely. Permit me to say that I went over your experimental plot and there is good clover there. Where I live, bone black has been used for twenty-two years. We are not here teaching that you must not go out and teach that a man who uses an acidulated fertilizer is necessarily going to put his soil into an unfertile condition. It depends upon the constituents of your soil; if you have an abundance of lime there and will put the humus into the soil with the acid phosphate to reinforce the natural supply of phosphorus it is safe, as is proved by the plots to which I have referred, if twenty-two years of practice prove anything. I am only cautioning those that push the acid phosphate without the use of lime or something to prevent or overcome the danger from too much acid collecting in the soil.

MR. PHILIPS: What percentage of lime would be ample?

MR. AGEE: I asked that question of Director Thorne just a few months ago. Eight years ago I began upon my own farm to use one ton of lime per acre; that is not much but I cut it down to one-half ton per acre and I have covered that farm with clover when the farms around me would not grow clover. I know men that have not used more than 500 pounds but I don't think their clover is so good. Director Thorne has finally gone up to 1,000 pounds per acre.

PROF. HAMILTON: I suppose the important question that is in the minds of the lecturers that are gathered here in hearing this discusion is, What shall we teach? Which side of this question shall we take? It strikes me that the way to discover what ought to be taught is to follow the suggestion made by the lecturer, Prof. McDowell, and send for the bulletins of the experiment stations that have been doing work along these lines at Rhode Island, Maine, Maryland, Pennsylvania and Ohio, and read them carefully, and then if you wish to make a talk that will impress itself upon your audiences, send down to the Department of Agriculture in about three months for an illustrated lecture upon soil acidity, that has been prepared by Director Wheeler—H. J. Wheeler, of the Rhode Island Experiment Station—in which there is a discussion on this subject, and the discussion is followed, or there is interspersed in the discussion, views of the effect of different treatment of different kinds of plants upon different sorts of soil. The figures were taken from and based upon growing crops. The lecture explains exactly the conditions that existed, and your audiences can see for themselves on the screen, the results of the experiments. These illustrated lectures

are being prepared upon several important topics and one of the most important, perhaps, is this which has been raised here this afternoon and I merely wish to call the attention of the lecturers to the fact that there will be a lecture—there is a lecture prepared now by a gentleman who has had more experience in the investigation of this subject than any other in the United States, and that you can have this lecture, or the loan of it for nothing, simply paying the expressage both ways, and if you think it is likely to be of advantage to you as a teacher, you can have it at a nominal price, merely the cost of the slides, by sending to the Department of Agriculture at Washington. A syllabus accompanies the lecture that gives the points that are to be made, and by obtaining these slides and the lecture, you can see what has been done along this line by the experimenters in the United States and in foreign countries.

MR. SEXTON: A moment ago Mr. Agee stated that the land that would not produce clover had been brought back to produce clover by the use of lime. Now, the fact that this land did not produce clover, was that brought about by the excessive use of phosphoric acid? We want to get down to something that is practical. We would like to have this information for the reason, that as we buy food for our animals, we buy food for our plants.

MR. PHILIPS: We have been accustomed to think and teach that clover is a gross feeder of potash, and that when we applied lime to the soil, the caustic of the lime takes the silica of the soil, and whereas certain elements among others are required, among them is potash, that this has been largely the cause that has produced the growth of clover rather than neutralizing the acid phosphate. Please answer that at some time as you go along, whether this lime did not help to produce this growth of clover largely by the liberation of the potash, and in the case you spoke of where your neighbor applied lime, was it not because of a deficiency of potash.

MR. AGEE: In this series of plots at the West Station Farm, we have among others one that has been treated by lime alone, one that has been treated by acid phosphate alone, and so on down the list. Prof. John Hamilton well said to you, that probably there is no more extended series of experiments lying out of doors in this country than on the West Station Farm. There are plots where the potash has been applied in abundance to the land, plots where acid phosphate has been applied in abundance and plots where nothing has been applied. On all three of them the clover is not growing right, but we have more clover where nothing has been applied for ten years than where the acid phosphate has been applied. There are perhaps plots where there is a little more clover where the acid

phosphate has been applied than where nothing has been given to the land.

Wherever acid phosphate entered into the soil, there is more sourness and less clover and some just like the dial on a clock. I was sorry to find the other day that some of these plots are contradictory, but wherever the acid phosphate has gone, the clover is not very good; where potash has been put on it is a little bit better and only where we have brought back that soil by the use of lime, is the clover good.

The DEPUTY SECRETARY: Which would you apply first, the humus or the lime?

MR. AGEE: Where the manure has gone on the plot without any lime, there the clover is not so good as on some plots that have had no manure but have had the lime.

A Member: Is not manure more valuable in getting good clover than lime?

MR. AGEE: Where you apply manure to the soil, you sweeten the soil, and most of the land that has grown sour, has done so because air could not enter it. The humus has been burned out of that soil and it is close together and in a condition of acidity. I am not enough of a chemist to explain all this, and I am afraid we are going to get this mixed. Wherever manure has gone without something to correct the acidity of the soil, we have not the strong clover seed that we desire.

MR. SEEDS: Will the same facts work out on every farm as it works out there?

MR. AGEE: No, I do not think they will.

MR. HULL: I have applied lime and cannot see that I have ever received a dollar of benefit from it. I never have used phosphate on land to produce clover. I have land that will produce timothy and fairly good clover. I would like to ask why timothy is not more used? I can grow a crop of timothy that will produce more humus to plow under than I can of clover and yet nobody says anything in favor of timothy.

MR. SCHWARZ: I would like to ask Mr. Agee a question. Is not the disappearance of clover entirely attributable to the overuse of lime. I think that is a fact that can't be disputed; that condition existed before acid phosphate was ever used or thought of. Acid phosphate did not bring it back, but made it worse. Now wasn't it because the lime exhausted the humus of the soil?

MR. AGEE: That is exactly true; but that does not prove anything against this idea that where lime is put to excess on the ground, it burns out the vegetable matter. Where you can control the moisture, you can control the soil, but that has nothing under the sun to do with this other proposition.

I feel that we must state the truth accurately because we are teachers, and if the soil is limestone, if you are failing to get clover, to affect a limestone soil, a thousand pounds of lime per acre is not sufficient; in that case you have got to use 50 or 60 barrels of lime per acre, so don't advise the men at the institutes to use a thousand pounds of lime on limestone soil, but tell them where clover is failing to make this test.

PROF. HANTZ: I have a field that has been limed, where a lime-kiln has been burned, and I have raised clover there for ten years, and to-day it is a thick meadow of the best clover, and west of it there is no clover. I would like to ask why is that clover growing there for ten years? If you don't believe this, you can come to my farm and see it, all matted over with clover. I know there have been hundreds of barrels of lime put upon that one lot.

MR. AGEE: In that case, he has simply grown clover and returned the humus to that soil, and the lime has done no harm, but the lime has done harm in Chester county at the places indicated. My friend over there, Prof. Hantz, is a pretty good farmer. It is not just that lime spot that produces on his farm, but he lets the clover roots return to that soil, the humus or vegetable matter that it needs.

MR. STOUT: I have not bought a bushel of lime for thirty years. Some seasons my clover crops fail and some seasons they do not. This year I had plenty of clover because there was abundance of rain; it rained bacteria, I presume, but I used fertilizers, frequently use them to the extent of 600 pounds to the acre. I raise a crop of vegetables and fruit and wherever I put the largest application of fertilizers I usually have the best crop of clover. I find the farmers in my section of the country, where they use the least fertilizer, have the poorest crops, no matter whether they use acid phosphate or some other fertilizer.

MR. KAHLER: I would like to ask Mr. Agee why he asserted that the use of acid phosphate would work out clover? My experience is rather, that it works in clover. I have got land that I couldn't raise clover on. If the gentlemen will come along with me I will show them as fine a piece of clover as they can see anywhere; by returning the vegetable matter back to the soil, I will take the

chances that I can get clover in an ordinary season, whether I use lime or whether I don't, and I will take the chances with the acid phosphate with that kind of treatment, without fearing that it will impoverish my land.

MR. AGEE: I didn't make the statement—there is nobody here that I would want to mislead; I didn't say that the use of acid phosphate would drive out clover, because right at State College, where there is limestone land, and where it has been treated with bone black, they will show you a beautiful and nice clover plot. I ask you, gentlement, when you get to State College, to look at It. You will get a lesson there, I do not doubt. Mr. Stout can use acid phosphate, I presume, because he has enough lime in that ground to prevent over-acidity. I did say, no matter how much manure you put there, if you plow it in and mix it well with the soil, and to answer the question over a little bit, I would like to have the manure on the land and try for the clover. I would use my litmus paper test and if I found that the blue paper turned red quickly, I would say I wanted by manure to take that acid out.

MR. BOND: I have concluded that it has resolved itself into a question of practice and not principle. A number of years ago I recollect there was a run of chills and fever in my county, and I suffered from them, and was run down so that the food which I took refused to do its proper work in my system. I resorted to quinine; that allayed the fever and cured the chills, and it improved my physical condition so that I could utilize the food I ate, and obtain strength. Now, suppose I had been dissatisfied because I had to discard bread and meat and live on quinine. Applying that to this matter of fertilizers, I say that we ought not to condemn commercial fertilizers because we can't discard everything else and grow our commercial crops on commercial fertilizers. Take a worn-out farm, and use a lot of commercial fertilizer and if we can't take care of the soil and produce good results after that, then we are not good farmers, and better give it up; but let us not condemn this medicine.

PROF. HAMILTON: I too went around the Experiment Station plots up at the State College and there I saw some things that perhaps Mr. Agee did not discover. I was quite familiar with the plot system, for I have given my attention to it for a good many years. I was attracted to this fact, that although it is true that on many plots where acidulated bone black was used, there is a fair stand of clover. It is also true that where sulphate of ammonia is added to any acidulated rock, there is an absolute lacking of clover. What does that prove? That the acidulation in the quantity of material used, that the bone black was not sufficient to re-enter the soil so as to

prevent a fair crop of clover being grown, or the bacteria in the soil being propagated and when sulphate of ammonia was used, giving to it an additional quantity of acid; although nitrogen, of course, is a constituent of this application, and an amount of acidity has been created that prevents the growth of clover absolutely on such plots. I hope that the lecturers here will go over the series of plots carefully. There should be a great deal of time given to the study of this fact right there, and you can see for yourselves that where the acidity is sufficiently great, there is no clover. That is also true in Ohio with which I have been familiar for two years by going back and forth. They have a long series of plots in which the invariable result is, that where this acidity exists you get no clover. Acidity is not the only thing that will prevent the growth of clover; that is another thing, and if you want to have a demonstration of that, I don't know a better place for it than right at my farm at State College. When you go up there I will show you something that I think will be of very great service to you for the rest of your lives. To me, it has been one of the greatest surprises of my life. This is on a plot of alfalfa. I sowed a small plot with alfalfa near my barn, right near the College, and it will be no trouble for you to go and see it. There is a small plot there which I wish to test thoroughly and I got this from the Agricultural Department at Washington that they said had been inocculated, and sowed it on this plot. I got some earth from Mr. Seeds, at Birmingham, that came from an alfalfa field that had been thoroughly inocculated. I gave directions to my foreman to cover the one-half of this plot with this soil, and leave the other half without any application, and if you will go there I will show you a plot on which the inocculated part is thoroughly green.

The seed in both plots was supposed to have been inocculated, showing two things; one was that the inocculation in the same way down at the Agricultural Department had not been efficacious, and the other is that there is a great deal in the manner of the inocculation of the soil in the growing of these leguminous plants and in the particular kind of germs needed for the growth of clover.

I want you to go over and see my home anyway, when you go up there, and I want you to see that experiment as a demonstration of the fact that there are other things that prevent the growth of clover besides acidity in the soil.

A Member: There is an article in the Century Magazine this month bearing upon this subject which I think well worth reading.

A Member: Does burned bone lose any phosphoric acid by burning?

The answer was, no.

"Is the use of sludge acid a detriment to phosphate on which it is used?"

Answer. Ordinarily, I should say not. Sludge acid is acid used in purifying crude oil, and ordinarily I do not believe it would contain anything injurious.

A Member: Of what are clover roots composed, and what are they worth per ton as fertilizers?

PROF. McDOWELL: I would not undertake to answer that question as to their value per ton as fertilizers, nor could I give the composition without referring to tables containing same. They are composed of the same elements mentioned as constituting all plants; clover roots would probably be found to contain considerable quantities of potash, but as to actual amounts, I could not state that.

A. Member: Prof. E. B. Voorhees, of New Jersey, gives many formulas for home mixtures; will you give the analysis of this one and the commercial value: "One hundred pounds nitrate of soda, one hundred pounds muriate of potash, two hundred pounds of salt, two hundred pounds of steamed bone and two hundred pounds of gypsum."

PROF. McDOWELL: Of course the nitrate of soda, the muriate of potash and steamed bone are the only materials that contain fertilizer ingredients. One hundred pounds of nitrate of soda would contain on an average sixteen pounds of nitrogen, valued at the present time about 16 cents per pound, would be $1.60 for the nitrogen derived from the nitrate of soda. One hundred pounds of muriate of potash would contain about 50 per cent. of actual potash, which at four and a quarter cents a pound would be about $2.12. Two hundred pounds of steamed bone would contain say 2 per cent. of nitrogen, which would be four pounds of nitrogen at 11 cents a pound, $0.44 and about 25 pounds—25 per cent. of phosphoric acid or 50 pounds of phosphoric acid at 3 cents a pound would be $1.50 making a total value of about $5.66 as the value of the actual fertilizing material. Of course the salt and the gypsum have no particular value, hence no value would be assigned to them.

On motion, the meeting adjourned to 7.30 P. M.

Bellefonte, Pa., Tuesday, Oct. 11, 7.30 P. M., 1904.

The meeting was called to order by Col. Woodward, Chairman, at the designated hour.

The CHAIRMAN: I find that the first number on the program is music. It was expected that we would have some singing by a couple

of ladies who are not able to be here to-night. Our friend, Mr. Hall, of Potter county, tells us that he will gladly sing us a little song, the title of which indicates that it will be entirely in unison with the subject of the evening.

Song by Mr. Hall, "The Old Farm Gate."

The CHAIRMAN: "Domestic Science in the Public Schools" is the title of the paper that will now be read by its author, Mrs. Wells W. Cooke.

DOMESTIC SCIENCE IN THE PUBLIC SCHOOLS.

By Mrs. Wells W. Cooke, *Washington, D. C.*

John Ruskin says of cookery: "It means the knowledge of Medea and of Circe and of Calypoo and of Helen and of Rebekah and of the Queen of Sheba. It means the knowledge of all herbs and fruits and balms and spices; and of all that is healing and sweet in fields and groves and savory in meats. It means carefulness and inventiveness and watchfulness and willingness and readiness of appliance. It means the economy of your great grandmothers and the science of the modern chemists; it means much testing and no wasting; it means English thoroughness and French art and Arabian hospitality, and it means, in fine, that you are to be perfectly and always 'ladies,' 'loafgivers.'" Such is Ruskin's definition of cookery. But how are our daughters to learn all this carefulness, economy and science. In former years their only chance for obtaining it was at home and many a child's home surroundings were such as to deprive her of proper instruction. At the present time the demand is being made that the State through its public schools shall offer to every child a chance to learn the fundamentals, not only in cookery, but in the other subjects that come under the head of domestic science.

All arguments in favor of manual training in schools apply equally well to domestic science. Each of these implies more than mere dexterity of the hand. They include an expansion of all the senses and enable the brain to express itself through the hand to the general improvement of the individual. Education of this kind should give keenness of observation, deftness of touch and also develop

the senses of smell and taste. In the past, domestic science was unrecognized and the whole trend of education was away from homemaking. Good citizenship and good government are possible only as the result of good homes; and our public schools can have no higher aim than to aid in placing the home life of the nation upon a higher plane.

Food is the pivot on which the temperance and labor questions revolve. A better use of money in providing wholesome well-cooked food would do much toward the solution of both problems. Foods which stimulate rather than nourish tend to produce intemperance, strikes and anarchy. The French Revolution has been ascribed to the half-starved condition of the people. What a man eats, that he is—or as the French have it, it is the soup that makes the soldier.

If, then, our food forms so large a part of the basis of our happiness, what more important subject for study can be introduced into our educational system. But the study of domestic science means more than the mere question of food. It means the consideration of the best conditions and methods of home life; how to feed, cloths and shelter the human being in accordance with the laws of his whole nature. These laws of life form part of other sciences which are considered essential to be taught in schools, such as physics, chemistry, physiology, biology, etc. Why should not the relation of these sciences to the welfare of the home be taught also, especially to the daughters of the race, the majority of whom will be the homemakers of the future. Indeed, domestic science is synonymous with homemaking.

What will be the advantage of raising household economics to the high rank of a science and what will it profit to dignify it thus? Much everyway. To make household science worthy the name will dignify household labor. Domestic work will then become the carrying out of principles by the intelligent industry of the better class of women and not the unskilled experimentation of the lower class of foreigners. To quote from a recent magazine article: "When domestic science is ranked beside grammar, geography and foreign languages in our educational system, housework will no longer be under a ban and the American kitchen will be emancipated from the tyranny of incompetent and wasteful domestics."

What scientific training has done to elevate the nursing of the sick into a profession worthy the best class of women, that will it do also to raise the work of the home to the same plane.

It is an acknowledged fact that the span of human life is longer now than in former generations. This results from our knowing better how to live than our forefathers. Increase and diffuse the best of this knowledge still further, teach the girls, and the boys too, the necessity of proper temperature, good ventilation, perfect

drainage and absolute cleanliness of the houses they live in, the advantages of nutritious food and proper clothing, and the following generations can bid defiance to consumption, typhoid fever and all the ills due to ignorant living. Another, and by no means the least consideration is, that the study of household science will surely tend to produce thrift and economy in the family and will thereby increase the wealth of the community.

It may be justly objected that there are no text-books and few teachers competent to instruct in domestic science. This is true at the present time; but the near future will see a different state of things. It is our duty as mothers and heads of households to create the demand for such teaching.

After the school days are over comes, in many cases, the introduction into society, the whirl of gaity, in which all thought of preparation for a life-work is quickly lost. Presently this young woman takes upon herself the responsibility of ordering a household of her own, a task for which she has had no training and in the performance of which she realizes, when too late, her pressing need of previous training and of executive ability.

Fortunate is the girl who attends a school where as much attention as possible is paid to domestic science, the study of which is made compulsory. She may, it is true, grudge the time taken from the other, and to her, more attractive studies, but the knowledge thus gained will eventually cause her to bless the hours spent in its acquirement.

The study of domestic science has an educational, a practical and a moral influence. Under the first comes neatness, order, the value of time and strength. Under the practical, comes proper methods and economy, and by these lessons at the present time economy is being introduced into thousands of homes. Upon the moral side, we will find that coarse girls are refined, and scholars who are dull with the book, often have marked success with the hand work, thus awakening their own self-respect and gaining the respect of others. Those who are reared in homes of wealth, equally with those born in poverty need this training. One of the great perils of this nation, as of all others, is the close distinction between the rich and the poor and the barriers that grow up between them. A part of this difficulty arises from the fact that many have grown up to despise those who labor with their hands. When the cultivated teacher is seen in the garb of the toiler and when all pupils, rich and poor, work with their hands together, labor is honored and ennobled and false ideas are corrected before they become fixed.

Undoubtedly, what can be taught in the schools will be but an outline and a beginning, a foundation to build on in the future, but

even this foundation of domestic science will be well worth all the time and trouble that may be spent in procuring its establishment.

If possible, it will be well to have such scientific training given equally to boys and girls, for such teaching will have a moral result as well as a technical value in teaching boys properly to estimate what they are now apt to scorn as inferior work merely because they deem it *woman's* work.

The pupil should begin to learn by going through all the operations from cleaning stoves and building fires, to the more artistic arrangements of the household. It is only by practical knowledge concerning every branch of labor that is carried on in a household, that a woman can have a feeling of real independence. It would seem that every person who can hold a brush ought to know how to scrub a pine table or floor. On the contrary, says one writer: "Imagine my surprise when the domestic scientist who was my instructor proved to me that the way I imagined it should be done was the way of all ways the worst. I wonder how many present have learned that an unpainted wooden table can only be kept in its most beautiful state of whiteness when scrubbed with cold water. It was at any rate a revelation to me who had supposed grease could be extracted only with the hottest of hot water."

What we need is to exalt the profession of homemaking; to show that it is as dignified and requires as much intelligence as other professions. While much of the work of the house can be, and is done by untrained women, it would be better and more economically managed if these women had more and better training. There are no talents too varied, no education too complete, no training too perfect to find use and exercise in household affairs.

The number of these handcrafts in the schools grows wider every year, and if the daily life can be made healthier and happier, what matter if a little arithmetic and language get crowded out. There should be no distinction of sex in the earlier lessons of the manual training and domestic science. The girls should learn carpentry and the boys cookery. While these lessons are in progress, the arithmetic lessons may be in the line of household accounts and the measurements of the grocery and the workshop. Each of the home sciences must, for the younger pupils, be reduced to its lowest terms. It is quite possible to teach the fundamental principles of cookery in a dozen lessons, and so long as we must eat, every boy and girl should be taught how to select and prepare simple foods.

Among the different branches of domestic science, the fact that cookery is so closely related to individual and social welfare, naturally throws into prominence its directly practical side. From the educational point of view, which takes into account all the pupil's relations in life, the claims of cookery to a place in our school cur-

riculum is stronger still. As a means of giving opportunity for the practical application of principles already set forth, as a form of labor requiring concentrated attention, forethought and planning, as well as deftness of execution, and for linking together all the other studies pursued, there is nothing equal to cookery. Its advantage, as hand and brain work combined, it shares with all the other forms of domestic science; but inasmuch as it gives gentle and healthful exercise, it is better than sewing or drawing, the two forms of hand-work most often taught to girls.

Three different methods of teaching cooking are in use: The demonstration method in which the teacher, with or without the assistance of the pupils, does the work which the pupils observe and are expected to practice at home; the group method in which several pupils combine ot prepare a single dish, and the individual method in which each pupil prepares a dish using small quantities of material. A combination of the three will be found best suited to public school conditions giving the preference to individual work whenever the nature of the material and the size of the class permits.

The lower the grade into which the branches of domestic science are introduced, the greater the number of children benefited thereby. This is one argument among the many which might be offered for inaugurating the reforms in the lower grades wherever possible. The opposite course is that which was at first adopted, putting domestic science in the highest grades. From this it is gradually working down and the scheme of education will not be at its best, until this work is begun in the kindergarten by changing it more or less to a kitchen garden, such as Emily Huntingdon has introduced so successfully into the New York schools, and which she calls "a system of teaching little children the rudiments of housework in a bright and cheerful way."

In some of the largest cities, hand-work can be carried through all the grades of the schools. If in the smaller towns it is not introduced into the lowest grades, it should not be delayed beyond the seventh grade. It is a common error to give such instruction to the high school girls rather than to the younger grades. As has already been stated, the lower the grade the greater the number of children benefited, as many children leave school at the end of the seventh or eighth grades. But there are other and weightier reasons. A little girl is delighted to try experiments she has seen grown people perform; she is more ready to follow the teacher's direction because she has not formed decided views of her own. There is also the chance that she is not yet bound to the American idea, that if an article is cheap it cannot possibly be good and, therefore, she may be taught to make savory dishes at small expense. A girl of sixteen

is strongly prejudiced in favor of the method to which she has been accustomed at home and will not readily try anything new. Boys are easier to teach because they know less of wrong housekeeping.

What has already been accomplished in the various cities of the United States, is the strongest argument possible for a wider dispersion of the same methods. These good results are the more remarkable, in the light of the few years since domestic science was introduced into the public schools. In the fall of 1885, cookery was made a part of the course in the grammar schools of Boston. In 1890, attendance was made compulsory for every girl in the seventh grade. Now over a hundred cooking classes, containing fifteen to thirty-six pupils each, are maintained in connection with the public schools of Boston. Cookery has formed a part of the regular course of study in Philadelphia since 1890. Brooklyn has in its public schools a course extending over four years. Yonkers, N. Y., organized this department in 1892. Since 1892, cookery has been taught in the public schools of Minneapolis, and with such success that one member of the school board said recently that, "now they could give up almost any branch easier than their cooking classes." In this city the girls range from eleven to eighteen years of age and come from the seventh and eighth grades. The course of lessons is made as practical as possible; "much attention is paid to the chemistry of cookery and the aim is to teach the pupils to prepare nutritious foods in an economical and attractive manner." What is true of this school is true of them all and they are now widely scattered from the east to the west and from north to south.

As to the cost of maintaining this department, the incidental expenses are much less than one would expect. In one school where 150 girls received twenty lessons in practical cooking and kitchen work, just $42.50 was expended and a quarter of this was for fuel In another school it cost only two dollars per pupil to give a large class of girls one lesson a week for the entire school year.

The desire for this class of instruction and the appreciation of its worth has not yet reached the stage where it is demanded by the smaller towns. This much-to-be-desired condition can be reached only by the gradual spreading of the leaven that is working in the larger cities, by the steady work in that direction of those engaged in teaching domestic science, and by the hearty co-operation of woman's clubs, farmers' institutes, and like organizations.

The farmers' institutes can be a living force in this respect and a beginning has already been made in this State, by the setting aside of one period of the institute as the "Woman's Session," or as the session devoted to the Farm Home. A portion of this session can well be devoted to presenting a plain statement of wheat is com-

prised under the head of domestic science, what portions of the subject can be most profitably introduced into the common schools and how best to make a beginning.

In several states the work at the institute has been carried still farther, and actual demonstrations in cooking have been given at one or more sessions of the institute. A few demonstration lessons given on such every-day subjects as making bread, pies, soups, broiling meats and poultry, cooking tough beefsteak, and preparing all sorts of common things properly and healthfully, would, I believe, arouse such an interest in cookery that it would be demanded as part of the regular course in every common school and would soon become one of the permanent and most popular branches of study.

The greatest objection I have heard to these cooking lessons, was the complaint that the men were just as much interested in them as the women and it took out so much time from what they were pleased to call the serious work of the Institute.

At present one session of the farmers' institutes in this State is devoted to the schools and much has been said at these sessions on the introduction of Nature Study into the school curriculum. All the arguments in favor of Nature Study apply equally well to the teaching of domestic science, and, indeed, the two can be taught together to the advantage of both subjects. One teacher has lately tried this plan and reports a great awakening in interest and a better grasp of the subject. For instance, when corn was the topic, the children in their nature study work took up the history of its original use by the Indians, its manner of growth, the composition of the kernel and its different parts. Then in the cooking lesson, the difference was shown between corn meal and corn starch, the effect of water, both hot and cold, on the starch, and finally, a simple dish was cooked, with corn as its principal ingredient. Other cereals and vegetables followed on succeeding days giving the scholars a good fundamental knowledge of the primary facts concerning the sources of human food.

It must not be supposed, however, that when domestic science has been introduced into all the town schools that its mission is ended. There is a wide sphere of usefulness for it, even in the country schools. You may question the possibility of cooking being taught in the ordinary district school; but one teacher at least has made it a decided success and I cannot do better than give you a short sketch of her methods.

The school committee and the teacher discussed the possibility of preparing warm lunches, the children doing the actual work, the teacher serving as buyer and instructor. The teacher estimated that a bill of fare for one warm dish each noon could be provided at a cost of two cents per day per child, each child bringing, in addition,

bread and butter. Arrangements were made that children who had not the pennies could pay for their dinners by doing some work for the teacher—the other pupils knowing nothing of this arrangement.

Ready money is scarce with some farmers; but milk and vegetables are plenty and the fathers often sent offerings that decreased the expense of the experiment. Each child brought two napkins, a knife, fork, spoon, plate, cup and saucer. Two napkins were needed, because each child had to use his desk as a table and tables must have table-cloths.

The equipment was partly provided by the school committee and partly donated. It took some planning to arrange the work so that lessons should not suffer nor be interfered with by the necessity for the cook's presence at the stove. Unless a girl had her lessons she could not serve as cook, and there were always others glad to serve in her stead. The cooking force consisted of one big girl, who ought to know something, and three helpers. This force was changed each week. The week's bill of fare was given to the big girl whose duty it was to see that everything was prepared before ten minutes of nine, that the room was neat, that the food was put on the stove at the proper hour, served properly, the dishes washed and all tidied again. The cooks reached the school by eight. The small girls learned by helping the larger ones. They learned to prepare delicious soups, or rather stews, various kinds of croquettes, griddle-cakes, the dishes served in cream like creamed codfish and creamed potatoes. They made various kinds of biscuit and learned to cook rice so that each grain was distinct and the rice not a soggy mass. The mothers become strong supporters of the scheme, as they said the children did not come home so tired from school when they had something warm at noon.

The children were encouraged to ask questions and the question box was opened on Fridays. The range of the questions showed that the pupils were thinking, and the girl who thinks is the best cook.

A small expenditure of money will fit any school for the cooking lessons. Interest and zeal on the part of teacher and pupils will make the work successful under difficulties. Economy in the use of time and materials, neatness and attention to one's work are good lessons to learn, and they will all come to the country school, where cooking is taught. Each teacher can work out for herself a scheme similar to this true history of one country cooking school.

The CHAIRMAN: I now have the pleasure of presenting to this audience at this time, Mrs. Mary A. Wallace, who will give her views on the subject of "The Country Home, Its Sanitation and Convenience."

Mrs. Wallace then read the following paper:

THE COUNTRY HOME, ITS SANITATION AND CONVENIENCE.

By Mrs. Mary A. Wallace, *Ellwood City, Pa.*

The habit of making excuses or apologies, is proverbial among women, and I presume I am no exception, for the reason that I feel that an apology is due to you members of this Institute, for my presence here on this platform.

Last summer, when I received a message from our Director of Institutes, Mr. Martin, asking if he might place my name on the program for this meeting, suggesting the subject which you see outlined, and urging me to respond promptly, as he was then making it up, I immediately, without giving the matter any thought whatever, replied that he could do so. Later, however, when it dawned upon my mind, that this would not be an ordinary farmers' institute, but an institute of Farmers' Institute Managers and Lecturers, I was appalled, as I then realized that most of you are, what might be termed "old" in this work, and more capable of discussing the subject than I, who am so "new." But it was too late then to retreat, and so I am here.

I am not here, however, in the interest of architects and contractors, to urge the building of new homes, with all the modern up-to-date sanitary arrangements, and conveniences, but will talk for a few minutes about the homes we have already, the old homes, perhaps, many of which seem to have been built without any regard to either sanitation or convenience.

We are told that God made the country, and man made the city. Such being the case we dwellers in the country are God's tenants, and, therefore, it is our imperative duty to do everything we possibly can to assist in keeping that country in as pure and healthful a condition as when the Almighty turned it over to mankind.

Then, too, farmers should beautify their homes, no matter whether it be a cabin or cottage or a mansion. There should be trees and shrubs and flowers and grassy lawns all about the homestead. Everything about the place should be kept in order; old rubbish kept cleared away, gates on their hinges, the palings and boards that come off the yard-fence should be replaced at once, or if it is only a rail-fence, every rail should be in its place. Unsightly old wagons, bug-

gies or machinery should be stored away out of sight or where they will not mar the beauty of the home scene. The fire-wood pile or coal pile should not be the first thing to attract the eye, and pens and outhouses should be kept in the back-ground as much as possible. All about the home there should be a pleasant air of neatness and thrift, as if it had a caretaker. I know of two roads that run parallel for a distance of several miles. One through a wide, fertile valley, the other on the plateau just above. I drove up the valley road one day not long since in company with a friend, a stranger, who, after we had gone some distance, remarked: "What a shiftless lot of people must live in this valley," and no wonder. There were patches plowed here and there and I presume sowed in something, in beautifully laying fields which should have been the finest of meadows, but which were overgrown with briars and shrubs and weeds. The houses had not been so bad originally, but with one exception, they were all in bad repair. They were unpainted, many of the window panes were broken, and the holes stuffed with old hats, old cushions or "any old thing" that was handier. Gates were down, palings off, and the dooryards littered with almost everything imaginable, while so many old buggies, carts, wagons, etc., lined the road on either side, in front, that one naturally thought of an ancient livery stable. A dark fog of dilapidation which was oppressive to the traveler seemed to have settled over the entire valley.

We came to a cross-road and went over to the hill road. The contrast was most marked. The houses were but little better than in the valley, but they were all nicely painted, and in excellent repair, the yards and lawns were beautiful and attractive and the fields were free from even weeds. One farmer as we drove along was throwing some dock over into the road. He told us those were "the last of the obnoxious weeds" on his sixty-acre farm and added, "I have had a long, hard battle with them." This was evidently the spirit that guided all the dwellers along that hill road, and over all seemed to rest an atmosphere of happiness, contentment and peace.

My friend turned to me and said, "Well, this is different. This is the best part of the country I've been since I've been here;" and friends, we weren't a mile away from the Valley of Shiftlessness.

Now it is not necessary for me to say here, as I would out in the country at a regular farmers' institute, that if any of your homes happen to be located in such a valley or even on Shiftler's Hill, see to it that you begin at once to beautify it, and fix it up, and make it as it were an oasis in the desert. Then possibly your neighbors will catch your spirit, and follow your example, and very soon the unsightly valley or hill will "bloom and blossom as the rose." We should do this, not for ourselves alone, not for the pleasure it will

afford the visitor or the traveler, but for our children, who, perhaps when widely separated, and we are sleeping beneath the grasses, will think of the old home place, although it may have been humble, as the prettiest spot they ever saw.

We naturally think, that of all places, the country should be the healthiest; but statistics prove, that in many sections the mortality is greater and cases of fever and other contagious diseases more numerous by far, according to the population, than in adjacent towns and cities. Why is it? I was early taught that all such afflictions were dispensations of Providence; but since I am older, I have come to believe that they are largely the result of the violation or neglect upon our part of some law of health, some unsanitary condition of the premises about our homes, or of the water which we drink.

Not long since I attended a public sale in one of the nicest sections in Pennsylvania. While waiting for the sale to begin, I went into the house where the wife of the owner of the property told me of the dreadful time they had had from early spring and all through the summer with typhoid malaria, the entire family of seven, with but one exception, having been very ill. I inquired if she knew of any cause for the disease. She replied not; that the doctors had examined the cellar and the drinking water, but found nothing that might cause the disease. Before leaving, I looked around the premises, as I had been so favorably impressed with the place. It was a low, but gently rolling farm, sloping down to a stream. The house stood on an elevation, and the cellar may have been all right. The well was within six feet of the kitchen door and the waste water from the pump run down an open ditch for perhaps 20 or 25 feet. At this point stood the family vault. There was no vault to speak of, only a continuation of the open ditch run down across the lot, ending in a low, flat field. The waste water from the pump was evidently supposed to carry off the contents of the closet, but it could not, there was not fall enough to have flushed it out with a force pump and hose, and in the warm days of spring, when the ground is saturated with water, just imagine what typhoid, malaria and other death-dealing germs must have been propagated in such a spot.

Nothing is more productive of disease than flat, filthy, undrained land, and stagnant water should not be permitted near the farm home, nor on the farm if it can be avoided.

And, while I am on this topic, I want to say that the ordinary outdoor closet in the country demands especial care, if we would avoid sickness in the home. Every dweller in the country should make it a matter of habit, to do everything possible, to keep the air, earth and water about their homes pure; absolutely pure. The cause of very much of disease and death in the country can be traced to the

bad condition of the ground around the house and premises and to the water that has been contaminated thereby. If there is not a system of running water and sewers, then all refuse water should be carried away in drain pipes. If drain pipes are not possible, then some sort of a receptacle, such as a small barrel in a wheelbarrow, or a barrel cart should be placed near the back door, and all liquid refuse poured into it, and twice a day in hot weather it should be wheeled away and emptied around the plants in the "truck patch," or the trees in the young orchard where it will do some good and no harm. Never, no never throw dirty water on the ground near the house or well or spring.

Another place we should watch carefully is our cellar. I have in mind a friend who one spring lost three of his children with diphtheria. There were no cases in the neighborhood, and upon investigation the doctors found considerable decaying vegetable matter in the cellar and attributed the disease to this cause. Cellars should be kept well whitewashed. If your cellar walls are rough and uneven, don't bother with a brush, but after sweeping down the walls thoroughly, daub on the whitewash with a broom. It does not matter so much about the looks, nor how smooth you make it, as that you get on plenty of whitewash.

My friend's cellar may have been the cause of his trouble, but it had a strong ally in the lack of fresh air and sunlight in the house. His is a peculiar family and I doubt if the house was once properly aired from fall until spring. Even in summer the windows were kept closed and the blinds closely drawn in every room not constantly occupied. We should air and sun our bed-rooms every day, and sun and air the bedding. Toss it over chairs near the open windows, and expose it to the sunshine, allowing it to stream in upon it long enough to perform its office of purification. Some one may say "sun fades the carpet." What if it does? A faded carpet is much to be preferred to sickness in the home, and anyway you should not have carpet on your bed-room floors. Did you ever see the floors in the wards of a hospital or sanitarium covered with carpet? Stain or oil your bed-room floors, and then you can lay some pieces of carpet, or nice light rugs here and there, which can be taken up and cleaned easily. I am glad to say that the day of carpeting bed-rooms is fast passing away. If your floors are very rough and uneven, then I would suggest covering them with some pretty matting which is preferable to carpet. And now while we are in the bed-room, let me say, do not shut out the night air when you retire, for no matter how well ventilated our rooms may be through the day, we cannot well get along without the pure fresh air from the outside to replenish that which becomes poisoned not only from the exhalations of the lungs, but also from the exhalations of the body. So if you would

have yourself and the members of your family awaken refreshed in the morning, see to it that your bed-rooms are well aired by day and well ventilated by night.

Another room that should be in every house, but which I am sorry to say is lacking in too many country homes, is a bath-room. You may not be able to have a modern bath-room with a fine tub, with its hot and cold water spigots, but every one of you can fix up a room, or at least a corner in some room that can be warmed in winter, to which yourself and the members of your family and the stranger within your gates may retire and take at least a good wash. If there is any one thing more than another which we should keep perfectly clean, it is these bodies of ours, so "fearfully and wonderfully made." Cleanliness is absolutely necessary in order that their manifold mechanism may not become clogged with the poisons generated within them and which emanates through the pores of the skin. We care for all the other machinery on the farm, but how little care many of us bestow upon that most intricate and most important piece of all machinery, our own body. Cleanliness is a mark of civilization and there is no reason why farm folks should not be the cleanest of people, yet (and I am ashamed to say it), I know farm men and women too, who very rarely indulge in a bath, while I could name others, who I doubt very much, if they ever take even a good annual scrubbing.

That "a clean people is a better people" is recognized in our larger cities where public bath houses have been established for the poorer classes, and which are well patronized. When the time comes that there will be a bath-room in every country home, when every farmer will dignify his vocation by a clean and neat appearance in his dress, and when no one will be seen on the public highway or streets of the town looking like a tramp, then will the caricatures of "old hayseed" and "Rube" disappear from the public prints forever.

CONVENIENCE OF THE HOME.

Well, as I have already said, some of these old homes seem to have been built without any regard to convenience, in fact, some of them are just as inconvenient as they could well have been made. Sometimes we see the cellar door as far removed from the kitchen as possible, sometimes the well is away off in one corner of the yard, where, perhaps, some fellow with a forked peach tree limb located it, Then again we see houses built on hillsides where one must climb anywhere from half a dozen to a dozen steps to reach the front door, with perhaps as many up to the side porch or kitchen door, and an equal number down into the cellar. Just imagine, friends, what tired, weary limbs and backaches, and perhaps permanent physical

injury that must be endured during a lifetime by those who do the work in a house surrounded by such steps. However, there can be little done to remedy a house so constructed except to fill up with earth where possible and reduce the number of steps, and then have a carpenter, who understands his business, come and see that they are constructed in the very easiest manner for climbing. Very often, too, by giving the matter a little thought, we can arrange things about the house that will greatly lessen the work of the women. The past summer, I called at a farm house ten miles from a railroad or town, and located some distance from the main road, from which the house could not be seen. Knowing that the wife had been a city girl, I inquired if she liked the country.

"Yes," she replied, "I do now very much, but when I first came here I thought I could not stay at all. The well, as you see is away out there in the front yard and the kitchen was so dark that, only on the clearest days, I had to keep the lamp burning. My husband encouraged me by telling me that he would fix things up just as soon as he could, and so he did. He built that reservoir up there above the house, had the water pumped into it, and now I have hot and cold water in the kitchen, and bath-room, and it is also piped to the barn. Then he had a large window put in the kitchen, and I have everything so convenient that I never long for the city."

Then, too, when you farmers think of purchasing machinery to assist in doing your work, look about and see if the women don't need something of that sort. Have they a good washing machine and modern churn, and how about their cooking utensils? Do they need any? Have they a good stove or range with an up-to-date roaster, broiler and steamer? If not, brother farmers, see to it that they are furnished with all these things so necessary in providing the good dinners of which you are so fond; and for the still more important reason, that in so doing, you will add largely to their happiness and contentment.

The CHAIRMAN: I know you will all regret that Dr. Warren cannot be with us to-night, as was expected, but we are going to continue the home subject by another song from Mr. Hall, entitled "My Childhood's Home."

The CHAIRMAN: Perhaps there is no one in Pennsylvania better equipped by observation and by careful study of the subject, to tell us of the uses and virtues of "Normal Schools of Agriculture" than our former Secretary of Agriculture, Prof. John Hamilton; and I now have the pleasure in presenting Prof. Hamilton to this audience.

PROF. HAMILTON: Mr. Chairman, Ladies and Gentlemen: I am sorry to inflict upon you a paper, for I know it is very much more

agreeable to you, also much more agreeable to a speaker, to speak without notes, but I understand that these proceedings are to be printed, and so you will have to bear with me while I read a paper that is not so very short, the title of which is "The Normal School of Agriculture for Institute Workers." That is what this meeting represents, as I understand it, and this idea is one of the most important just now that is demanding the attention of Institute Directors.

As I understand it, these meetings are for the purpose of doing two things: One is, letting the lecturers see what scientific men have that is up-to-date in their profession; and the other is, that the lecturers themselves shall have an opportunity to have inflicted upon them some speeches that they are accustomed to inflict upon others, and thereby awaken sympathy for the average institute audience.

Prof. Hamilton presented his paper, which is as follows:

NORMAL SCHOOLS OF AGRICULTURE FOR INSTITUTE WORKERS.

By Prof. John Hamilton, *Farmers' Institute Specialist, Washington, D. C.*

Farmers' Institute workers, whether they be the managers in charge of the institute organization and responsible for its development and success, or the lecturers or teachers giving instruction in the institute school, occupy an important place in the new agriculture, and are as much a necessity in agricultural education as are machinery and improved animals or plants in modern farm practice. They have come into existence to satisfy a need in farming; the need for reliable and useful information respecting agricultural operations. Every rural community is suffering for lack of this kind of information, whether it be old and highly progressive or new and correspondingly backward. The need is universal; it is urgent, and it is paramount in importance to agriculture.

SYSTEM OF PUBLIC EDUCATION.

When our system of public education was established it seemed to have been assumed that the adult farmer, by reason of his years, was capable of taking care of himself. That with such instruction as the common school gave, he would be able to understand the forces with

which he was to deal sufficiently well to enable him to use them, if not to the best possible advantage, at least skilfully enough to secure a livelihood for himself and family.

So long as soils were new and until their natural supply of immediately available plant food had become exhausted, this theory appeared to be correct. When, however, lands became poor and crops, consequently, began to grow less, and when the best farmers were unable to arrest this decline, it became evident that more was necessary to equip a farmer for his calling than the meager education given in the old-time public school. The days when anybody could farm had departed along with the fertility of the virgin soil that had made such agriculture possible, and the new era—the age of restoration and conservation—was ushered in, in which only the well-informed could hope to succeed.

Even when this became evident, and our fathers undertook to provide relief it did not occur to them that at least partial remedy might have been found in readjusting and improving the curricula of the rural schools, but they left these schools in their old condition and proceeded to establish colleges for the higher education of the sons and daughters of farmers, into which comparatively few could ever hope to enter.

FARMERS' INSTITUTES.

The great mass of farmers were unprovided with means of instruction until the farmers' institute was organized about 20 years ago. That it meets a need in agriculture, is shown by the attendance at these meetings last year of about one million farmers, and by the demand that is general in all of the states for a larger number of institutes, and for more and better equipped teachers. All of the states, excepting three, have now adopted a system of farmers' institutes, and in most of them support from the public funds is given in recognition of their educational character and of their great practical value to agriculture. Like every other educational institution, the institute can progress no faster than as teachers are supplied to give instruction, and can rise no higher than as these teachers are qualified for their work.

The farmers' institute is an educational institution, and is dependent directly for its efficiency upon two classes of officers: The managers, who have charge of the organization, and the lecturers, who give instruction.

THE INSTITUTE MANAGER.

Unless the managers have, in marked degree, the power of organizing the work upon broad and progressive lines, it will not succeed, and unless they have ideals in agricultural education that are high and

far reaching they will be content with inferior teachers and minstrel show entertainments. The need for men of superior qualifications for managers is just now specially important.

The institute movement is in its formative stage, where it needs the most careful planning and direction in order that its organization and scheme of instruction may be perfected. Unless these foundation matters are in capable hands the work will not only not progress but it is sure to rapidly decline. Improvement can only come from careful study of the questions involved in rural education, and by painstaking effort to carry into operation high ideals. Hitherto, there has been but slight opportunity for conference among local managers for determining what are the most efficient methods in institute development, and for settling upon ideals in institute instruction. Those in control of railroads, mills, mines and mercantile enterprises, find that trained managers are a necessity if their business is to succeed. Formerly, when nothing better was possible, the training came through a long apprenticeship and experience in the practical work of the business. Now it is secured through schools of study, in which principles are taught with sufficient practice to fix the principles well in mind.

A method for the training of efficient managers is a much needed addition to the institutes. These managers are responsible for the form of organization of their local meetings; for the proper advertising of their institutes; the formation of committees; for the preparation of the course of study or program that is to be presented; for the selecting of teachers, the number of sessions, the localities in which institutes are to be held, and substantially for the whole work of organizing and conducting the school. If the series of meetings are a failure the local managers, first of all, are held responsible. If they succeed, it is largely due to the efforts that they put forth.

Success from the managers standpoint at present consists in a full house made up of agricultural people, an interesting and instructive program, and a corps of capable teachers. Success in the future will require much more than this. When the county institute is so organized as to meet each month and have auxiliaries in every township and community, which likewise hold stated meetings; when it will own a farm, stock-breeding barns, plant-improvement plots, and demonstrate the value of methods by practical tests, and when lecturers will be employed by the year, at least one for each county in a state, the position of the institute manager will be wholly different from what it is to-day. He will be a paid official and will need a kind of training that the average manager does not possess; a kind of equipment that can only come from the study of science and from experience in work of experimentation as it is now being conducted by the best agricultural experiment stations of the country. The

local manager is destined to be the most important factor in the institute work in the future—a superior man, thoroughly educated and trained.

The line of development in institutes is even now in the direction that I have indicated, and it is likely to be on us as a living question before we are prepared, unless we begin now to educate men for the new duties which the developed system will impose. We are now but in the kindergarten stage of the institute idea in education. The increasing needs of men will demand that it be perfected, and its progress toward this perfection can only be by adding to its power to impart valuable information and by extending it so as to be in some form or other within the reach of every citizen every day in the year; in other words, to make it highly educational and constantly and universally useful. To hasten that day, training schools for institute managers are a necessity.

THE INSTITUTE TEACHERS.

The other class of workers upon whom the institute is dependent for efficiency is, as has been stated, the force of teachers. Unless this is efficient the institute is a failure, no matter how carefully it has been organized, or how well attended, or how judiciously the topics to be treated have been chosen. The teacher is the life of any school; more than the text-books or buildings or equipment, necessary as these are. If he is uninteresting or otherwise incapable, all of the trouble and expense previously incurred is wasted effort and money; like a great manufactory, equipped with intricate and costly machinery, suited to the production of beautiful and perfect fabrics, but rendered worse than useless by reason of its being manned by unskilled or careless workmen.

Institute instruction is a new profession scarcely 20 years of age in the oldest states. It began in weakness but has grown until now it requires strong men to teach institute audiences. Many who were acceptable lecturers 20 years ago are not now asked to teach. They have failed to keep abreast of the advance of science and their advice is no longer sought. Many also who have succeeded admirably with classes of students in college or university work and whose capability, so far as learning is concerned, is admitted, find themselves altogether unfit to give instruction to audiences of farming people. This work is a profession difficult in the extreme and requires peculiar training and special personal qualities and experience to properly perform. The audiences are composed of all classes, both men and women, boys and girls, the scholarly professional man and the illiterate. The meeting is voluntary; all are free to come or go at will. There are those who are deeply interested in the subjects on the program, and others who care nothing for the

topics, a mixed audience, with varied interests and occupations, to be held from 30 minutes to an hour, and given valuable instruction in a way to interest and receive the attention of the thoughtless to the end; all to be accomplished without the loss of dignity by the lecturer and without catering to any popular prejudice that may prevail. To those who think this easy the answer is, attempt it and discover for yourself. To do such work well requires a high order of attainment and the men who completely and conspicuously succeed are few.

Nevertheless, if the institute is to fulfill its mission as a teacher of agricultural truth and is to take its proper place among the educational institutions of the time, it must be equipped in a great degree with precisely such a force. All who undertake to teach in this school of applied science must possess in more than ordinary degree the qualifications that distinguish these superior men. Moreover, if the institutes are to be extended until they reach the many millions who need their help, the force of teachers will have to be increased twenty or even fifty-fold.

SUPPLYING INSTRUCTORS.

The important and difficult question that now confronts the friends of institute work is, How can the supply of capable institute instructors be increased?

Hitherto, State directors have depended upon picked-up help for lecture service; upon the agricultural colleges and experiment stations for expert scientists to teach the science of agriculture, and upon such successful practical farmers as can be induced to leave their work and take a place upon the force for giving instruction respecting the practical operations of the farm. The rapidly expanding work of the agricultural colleges and of the experiment stations is each year making it more and more difficult for members of the teaching and experiment station force to be spared from their duties at these institutions. Unless these colleges and stations employ a special force of experts to represent them in the farmers' institutes, the time will soon come when very few of their number will be in the institute field. Even now, many directors are dependent almost entirely upon laymen for service as institute instructors, with the prospect that, unless something of the kind suggested is done, of being wholly deprived of college and station help.

For the year ending June 30, 1903, the colleges and stations of the United States furnished 196 members of their staffs for the institute work out of a total of 924 lecturers on the force. These lecturers contributed 1,666 days of time out of a total of 4,880 days of insti-

tutes reported, being 20 per cent. of the lecture force, and showing that they were present at 30 per cent. of the institutes held. In 13 states and territories the entire institute work was performed by the agricultural college and station men, and in five others more than half of the force was made up of college and station officials. It is evident that unless some means are devised for aiding the colleges and stations in these states, that very soon the institute work must be abandoned and what has been gained at so much cost and effort will be lost.

SOURCES OF SUPPLY.

There are three possible sources of supply for the institute lecture force. The first is from the faculties of the agricultural colleges and the staffs at the agricultural experiment stations. The supply from these sources, as the colleges and stations are at present organized, cannot be materially increased and is likely to diminish each year, as these institutions expand their work. The second is, for these institutions to employ a special force of experts who shall be field men, who shall represent them in the institute work, and also be itinerant instructors in agriculture in the intervals between the regular periods of institute service. Such a force could be indefinitely increased, according to the appropriation that could be secured for meeting their salaries and expenses. Such action on the part of these institutions would be most advantageous to them and be of great assistance to the institute work.

The third method for enlarging the force of teachers, is, for the State directors to search out capable farmers who have succeeded along at least one line of agriculture, and train them for institute teaching work. The supply of such men ought to increase each year as better methods of agriculture become known and practiced and as the colleges send out graduates to take up agricultural pursuits. Most of these men have had excellent training along practical lines which fits them for institute work as no mere theoretical knowledge possibly could. They lack, however, an important qualification which every capable teacher of agriculture must possess; the ability to give the reason or explanation of results so as to get at the principles that control and affect the result. They also need to know and to use the exact methods in experimentation and interpretation of the results that the skilled investigator employs. They must acquire the scientific method, so as to be able to present in a convincing way the principles that they advocte. They must adopt the method that takes nothing for granted in an experiment; that leaves no gaps unaccounted for, and no parts unexplained.

INSTRUCTING THE LECTURERS.

Some institute directors have come to see that something must be done to insure that their lay teachers are informed in regard to the present status of knowledge respecting their specialities, so that there may be no conflict in teaching among the members of the force. With this in mind, the director of one state—New York—has been assembling for a few days each year his entire lecture force at the State Experiment Station and at the Agricultural College to receive instruction. Last year this course was extended to cover two weeks, during which expert teachers of agriculture science gave lecturers upon their several specialties for the benefit of the institute lecture force. Other states have been doing similar work.

These courses of lectures were designed for the lecturers now composing the institute crops. However valuable such a course so given may be to the existing force of teachers, it will not meet the needs of the work unless it brings into the service others who are needed and who might become, if trained, valuable additions to the institute. The school that is to meet the needs of the institute work must go further than provide for the giving of a few days instruction to the lecturers now at work. It must reach out to the many successful and intelligent farmers of the country who, if discovered and given proper opportunities, would soon equal if not surpass those now teaching in institutes. The problem is not merely how to increase the efficiency of the present workers, although that is very important, but to discover some practical and effective means for permanently and rapidly increasing the number.

EFFECT UPON PRODUCT.

If a sufficient force of teachers of agriculture were at work constantly in each state instructing farmers and demonstrating the value of new crops and new methods, the production of the country would speedily be greatly increased.

Five dollars added to the value of each dairy cow would increase the wealth of the farmers of the United States over ninety millions of dollars ($90,563,535).

Two dollars added to the value of each of all other cattle would increase it by over one hundred million dollars ($102,632,102) more.

Ten dollars to each horse would increase their income by over two hundred and thirteen million of dollars ($213,168,880).

Thirty eggs added to the annual production of a hen, whose average yearly output is now but 66, when it might be 200, would add over $64,000,000 ($64,706,669).

One pound to each chicken at ten cents per pound would amount to over $23,000,000 ($23,359,808).

One-fourth increase to the present product of fruit would amount to over $19,000,000 ($19,118,319).

One-third added to the present product of potatoes and grain would be more than $524,000,000 ($524,540,836).

One-third added to the staple products would amount to over $306,000,000 ($306,618,511), and with like additions to other crops and animals not enumerated, would reach a total of $1,442,419,469, all added to the present product and all going into the farmers' bank account.

This prepares the way for the more direct discussion of the topic assigned me in this paper—"Normal Schools of Agriculture for Institute Workers." What kind of a school should this be?

OF SUPERIOR GRADE.

A school for preparing men and women to become efficient workers in farmers' institutes ought not to be of an elementary or primary grade. The kind of information that is needed in institutes is the latest and most advanced, and if the workers are to be able to furnish it they must have had the advantage of superior training. The best is none too good, and only the best is good enough. This means that the force of teachers must be composed of capable men, thoroughly informed with respect to the sciences that affect agriculture and with the details of practices that are most approved. No half-educated scientist is fit to teach in such an institution, any more than a half-trained classical scholar is fit to teach in the University of Athens.

The men and women attending such a school have had for the most part much experience in practical agriculture and most of them have more than ordinary education. They come not for general culture, but for receiving instruction in some speciality in which they are already well-informed. They are, therefore, in a sense post-graduate students of agriculture so far as their specialities are concerned.

MUST TEACH SPECIALITIES.

The school that is to be adapted to their wants will need to provide for the teaching of numerous specialities. This will necessitate a large faculty of expert specialists to give instruction, all of whom should be teachers of experience. Specialities in institute work differ in character from those ordinarily taught as specialities in college. A man who lectures in the institutes on dairying is a specialist in institute work. But in a training school for preparing men to give instruction on dairying, there would be needed the services of several specialists: One on bacteriology, one on chemistry, one on animal physiology, one on animal nutrition, one on the management of milk and cream and one on butter and cheese; all experts, whose special qualifications are needed to train the institute lecturer who is to make the giving of dairy instruction a speciality. A similar

force of experts will be needed for the proper training of specialists along other lines, thus requiring a large number of skilled teachers to properly equip such a school.

ORGANIZATION OF A NORMAL SCHOOL.

How shall such a school be organized? Experiments in normal school work for institute workers have thus far been confined to assisting the lecturers and have not included the other classes of workers known as the managers or directors of the institutes, who, as I have indicated, will be equally important features in the institute of the future. The number of managers will greatly exceed that of the lecture force by several times. Experiments thus far made also show, with a reasonable degree of certainty, that no single state is at present able to establish, equip and properly conduct a normal school of agriculture such as the institute work now demands for the education of its lecturers.

The first practical difficulty in the way of any state undertaking to establish such a school is the fact, that the institute lecture force in most of the states is comparatively small. Because of this and by reason of the limited number of instructors available at any one institution, it is almost impossible to divide the lecture force into classes of sufficient number that the instruction given may be suited to the peculiar needs of the several lecturers in the line of their specialities. Unless this can be done each student will be obliged, if he wishes to occupy his time, to attend all of the lectures, whether the subjects are those upon which he desires information or not, and thus during the entire course he may have had but one or two lectures on his particular speciality.

The second difficulty is, that most of the agricultural colleges and experiment stations are not as yet sufficiently equipped in their teaching force of experts to do more than cover a quite limited range of topics. Some institutions make a speciality of a single phase of agriculture, as animal husbandry, forestry, irrigation, plant breeding, soil physics or other branches of farming, and are not prepared to give advanced or post-graduate instruction in the particular subjects which the institute lecturer expects to teach.

A third difficulty is, that no one institution can afford to give the use of its teaching force for the length of time needed to make a course effective. A four or six weeks' term is an impossibility for any agricultural college or experiment station, and yet this is not too long for institute workers to devote to the study of their several specialities. One week is about as much as any institution can contribute annually outside of its regular work, and this is too short a period for the proper treatment of the subjects that need to be considered.

SEVERAL STATES UNITE.

For the present and until the agricultural colleges have been greatly strengthened and until the institute force has been greatly enlarged, it will be necessary for several states to unite in a normal school to be held at different institutions each year and to be equipped with a teaching force contributed by each. This would overcome the difficulties mentioned, and make it possible to classify the students and thus enable them to devote their time to subjects that more nearly relate to their several specialities. No one institution would be seriously embarrassed by the loss of the number of its teaching force, which it would be called upon to furnish, and the additional number of subjects offered in such a school would give a character to the meeting and enthusiasm to the teachers and scholars that would do much to popularize it and give it standing among educational institutions.

An essential feature of a school that is to train institute lecturers is, that it shall be in contact with field demonstrations or experiments in agriculture that are conducted along scientific lines. By changing the location of the normal school each year to a different institution, the students would have the advantage of contact with a wide range of experiment work, and thus be far better equipped for giving instruction than would be possible if they had only visited a single institution. The expense to the students would be but slightly increased by this method, and the extended acquaintance with fellow-workers and college experts thus formed would be of lasting benefit. States might be grouped whose agricultural interests are most similar, as for instance, New York, New Jersey, Pennsylvania, Delaware, Maryland and Ohio. These six states represented in 1903, an aggregate instruction force of 217 lecturers. Fifteen of these lecturers were reported as being connected with the experiment stations of the several states or the faculties of their agricultural collges, leaving 202 who would be likely to be in attendance at a school formed by a union of the six states designated. If there were added to these, one local manager for each county in these six states, numbering 262, there would be a total of 464.

It is reasonable also to expect that others, knowing of the normal school of instruction provided and of its high character, would be attracted in perhaps considerable numbers, thus adding to the classes that would annually assemble.

Suitable courses of study for such a school could be prepared by the deans of the agricultural faculties of the several agricultural colleges and by the directors of the experiment stations of the states interested, together with the State directors of institutes for these states, this body forming a board of control. These represen-

tatives could also select the teaching force or faculty of the normal school each year, and make requests to the respective institutions for the assignment of the persons selected.

The courses of study should be constructed so as to require at least two years for their completion, and a certificate could be given to those who satisfactorily pass the examinations in any one or more of the courses offered.

EXPENSE.

The average cost to the students in such a school need not exceed $100 per term of eight weeks, distributed substantially as follows:

A matriculation fee of	$25 00
Eight weeks' board and room, ...	40 00
Certificate of graduation, ...	5 00
Transportation charges, ...	30 00
	$100 00

The cost for maintaining such a school would vary as the faculty is increased. No doubt the work could be begun with a force of 12 lecturers on the faculty staff, or two from each state, changing the men from time to time as the needs of the school required. The college and station officers and the State directors would no doubt contribute whatever deficiency might arise from the failure of the matriculation fees to meet expenses. The matriculation fees of 250 students would amount to $6,250. The salaries of 12 professors for two months at $100 per month would be $4,800; salary of a permanent secretary would probably be $1,000, making a total of $5,800 for these items. There would also be the expenses for postage, advertising, traveling expenses of the board of control, and other incidental items. It would be expected that the halls, recitation rooms, and equipment for illustrative purposes would be furnished by the institution at which the normal school is held.

A graduate school of agriculture, similar in character to the normal school just stated, was held at Columbus, Ohio, for a period of four weeks, and was supplied with a faculty of 35 teachers at a cost slightly less than $4,000 for the term ($3,945.12).

WHAT MAY BE ACCOMPLISHED.

What such an institution could accomplish in an educational way in fitting specialists for their duties by devoting their attention to a single study, can be approximated by considering what is now accomplished in fitting young men in college in the line of mechanic arts in the brief space allotted to such study. Sixteen weeks of six days

each in the two-years' course proposed for the institute lecturers, with three hours each day given to lectures on a speciality, three hours to practical work, and one hour to a lecture on some subject of common interest, would give 288 hours to instruction in the students' speciality. This amounts to 96 hours given to lectures on general subjects; 283 hours to practical work; library reference work and special reading, two hours each day, 192 hours; a total of 9 hours per day for study, recitation and practice work, or 864 hours given to instruction, all but 96 of which are devoted to a special line of study.

Compare this with the hours assigned to special topics in the course of study for an agricultural college, as prepared by the committee of the Association of American Agricultural Colleges and Experiment Stations, submitted at the meeting of the Association held in Washington, D. C., November 17, 1903. The time given includes the practical as well as the class-room work.

	Hours.
Chemistry,	330
Botany,	180
Physiology,	180
Horticulture and forestry,	180
Veterinary medicine,	180
Zootechny,	160
Agronomy,	140
Zoology,	120
Dairying,	70
Meteorology,	60
Farm mechanics,	60
Rural economics,	60
	1,720

Here are 12 agricultural subjects, with a total of 1,720 hours, or an average of 143 hours to each, the highest being chemistry, with 330 hours. This comprises the agriculture in a 4-years' college course, while in the normal school, as outlined, each specialty could, if necessary, in the 16 weeks have devoted to it 768 hours, or more than four times as many hours as are given to the highest number in the 4-years' course just quoted, except the number given to chemistry, which includes 150 hours for general chemistry.

The Pennsylvania State College gives 390 hours to French, and 400 hours to German. Harvard University requires in its classical course 570 hours in Greek, and the Divinity School at Yale devotes but 1,036 to its entire 3-year course of preparation of men to preach the Gospel.

CAPABLE OF EXPANSION.

Another feature of these institute normal schools of agriculture is that they are flexible, capable of unlimited expansion at very little increased cost. No money is needed for apparatus or libraries or buildings or land, animals or equipment. All that is expended goes into teaching and all that is required for expansion is to add from time to time to the faculties of instructors as the students increase and the courses of study multiply. A greater or less number of states can unite as circumstances warrant; the number can be readjusted as experience demonstrates to be necessary.

PLACE INSTITUTE EDUCATION WHERE IT BELONGS.

The union system, moreover, will interest all of the colleges and experiment stations in the institute work; will give the advantage of wise counsel in the preparation of its courses of study; will secure uniformity in teaching and in the subjects taught and will place the moulding of institute education where it legitimately belongs, in the hands of institutions whose distinctive work is to give instruction in agriculture.

INSTRUCTION BY LECTURERS.

The instruction in such a school would of necessity be given by lectures. To make these lectures most useful in their immediate effect as well as permanently valuable, and also that the time of the professors and students may be most advantageously used, full notes and a syllabus should be prepared and printed by the instructors for distribution to their classes before the lectures begin. No lecturer should be engaged to teach who would not supply such a syllabus. It is important that the students shall have the lectures throughout in the exact form in which the lecturer presents them, inasmuch as many of the facts given are to be quoted in their subsequent work as teachers in the farmers' institutes of the country.

INITIATING THE MOVEMENT.

Who shall take the initiative in the inauguration of such a set of schools? First—The plan should be approved by the American Association of Farmers' Institute Workers, and second—It should be taken up by the National Association of Agricultural Colleges and Experiment Stations and thoroughly discussed in all of its details. If found to be feasible, a meeting of the State institute directors, with representatives of the National Association of Agricultural Colleges and Experiment Stations could be had, the plans be perfected, the states be grouped, teachers be selected, and all arrangements made for the immediate opening of the schools.

Such a set of schools properly equipped will do as much to assist farming people as any other single institution in existence, important as many of them are. The providing for the instructing of men and women out on the farms so that they may understand the mysteries of their occupation, teaching them to believe in it and love it, is worthy of the efforts of our most earnest and capable educators, and the maintenance of such a system is a duty which each state will, according to its ability, no doubt cheerfully undertake.

THE NEXT GREAT ADVANCE.

Interstate normal schools of agriculture for institute workers is the next great advance that the institute movement is destined to secure. When this is had, then the great need of the institute movement will be supplied. The need for means for equipping a large number of capable and enthusiastic men and women who shall carry the news of a better agriculture to farming people. When such institutions are established, many problems that now retard the progress and development of country life will speedily and satisfactorily be solved.

SUGGESTED GROUPING OF STATES AND TERRITORIES FOR NORMAL AGRICULTURAL SCHOOL PURPOSES.

Groups.	Lecturers.	Number of counties.	Agricultural population.
Group 1.			
Maine,	9	16	243,063
New Hampshire,	14	10	118,948
Vermont,	26	14	138,830
Massachusetts,	68	14	165,515
Rhode Island,	1	5	25,713
Connecticut,	21	8	119,003
Total,	139	67	811,072
Group 2.			
New York,	66	60	1,010,376
New Jersey,	38	19	160,111
Pennsylvania,	58	67	1,077,661
Delaware,	19	3	45,260
Maryland,	7	24	230,480
Ohio,	29	89	1,237,790
Total,	217	262	3,761,678
Group 3.			
Virginia,	3	118	867,758
West Virginia,	16	55	487,070
North Carolina,	8	97	1,145,755
Tennessee,	7	96	1,135,585
Kentucky,	11	119	1,153,032
Missouri,	31	115	1,340,079
Total,	76	600	6,129,279

Groups.	Lecturers.	Number of counties.	Agricultural population.
Group 4.			
South Carolina,	12	41	759,959
Georgia,	8	137	1,077,136
Florida,	22	45	187,989
Alabama,	11	66	1,060,644
Mississippi,	15	75	1,075,030
Louisiana,	13	59	554,031
Arkansas,	*	75	870,878
Total,	81	498	5,585,667
Group 5.			
Indiana,	39	92	973,870
Illinois,	84	103	1,219,852
Michigan,	97	83	993,342
Wisconsin,	22	73	825,278
Minnesota,	13	85	779,470
Iowa,	*	100	1,037,811
Total,	255	536	5,727,823
Group 6.			
Kansas,	16	108	763,186
Nebraska,	33	90	564,072
North Dakota,	11	43	217,657
South Dakota,	*	57	249,776
Colorado,	9	55	104,701
Wyoming,	*	14	27,296
Montana,	16	28	60,588
Total,	85	395	1,987,276
Group 7.			
Texas,	*	220	1,768,251
Indian Territory,	*	8	187,579
Oklaboma,	6	26	289,188
New Mexico,	5	22	55,272
Arizona,	4	22	30,362
Total,	15	298	2,330,652
Group 8.			
California,	23	61	308,891
Oregon,	6	38	163,760
Washington,	3	42	155,430
Idaho,	9	5	74,091
Nevada,	5	17	8,170
Utah,	10	29	96,308
Total,	56	192	806,650

*No report of lecturers.

SUMMARY.

Group 1,	139	67	811,072
Group 2,	217	262	3,761,678
Group 3,	76	600	6,129,279
Group 4,	81	498	5,585,667
Group 5,	255	536	5,727,823
Group 6,	85	395	1,987,276
Group 7,	15	298	2,330,652
Group 8,	56	192	806,650
Total,	924	2,848	27,140,097

The CHAIRMAN: This ends the program for the evening, and I have no doubt that it would be a very wise thing to adjourn promptly, with our minds all filled with what we have just heard; but we have got something else on hand. We are all to go to State College to-morrow. I have already announced that we go on a special train leaving here at 8.15 sharp, to-morrow morning.

On motion, the meeting adjourned to 9.30 A. M. to-morrow at State College.

State College, Pa., Wednesday, 9.30 A. M., Oct. 12, 1904.

Meeting was called to order by J. S. Burns, Chairman.

The CHAIRMAN: The first thing that we have on the program this morning, is an address of welcome by President George W. Atherton of the State College.

Dr. Atherton's address is as follows:

ADDRESS.

By Dr. G. W. Atherton, *President State College, State College, Pa.*

Mr. Chairman, Ladies and Gentlemen: I do not propose to take much of your time at this stage of the proceedings, and certainly not later, but I have very great pleasure in welcoming so large a representative body to spend a few sessions with us in the consideration of questions that are vital, not only to the industry in which we are all interested, but which are vital to the well-being of the whole nation.

I shall not dwell upon the common-place statement that agriculture and agricultural industry lies at the foundation of all other industries. Those are matters too frequently recognized and too frequently mentioned among ourselves to need repetition; but I go back of all that. I regard the rural class—not simply those engaged in agriculture but those who live in the rural regions—as the hope of the Republic. The great cities with their feverish, anxious and hurrying life, wear out too fast, and if the great cities were not constantly recruited by a continual stream of life from the country districts—the rural districts—they would very soon go to decay. Now,

the men in the rural regions accordingly should see clearly for themselves that they have not only to take care that their own industry shall be such as to hold and lure and satisfy the ambitious young men and young women of those regions, but they have it also in charge to see that these young men and young women are raised to a degree of intelligence that will enable them to compete with the most intelligent classes of the great cities where every opportunity is spread broadcast before them.

It is from that point of view that I welcome, not in any perfunctory words, but with the sincere expression of my heart, this great and representative body. I call it a great body; it is a sifted body. You have come from various parts of this great Commonwealth, the queen of all the commonwealths in the Union. You have come here selected by various processes of choice, until this morning you represent a sifted body, and you are going back to your communities, I hope, having secured some new light, some fresh inspiration and some higher purpose, because each of us from day to day ought to make substantial progress toward higher advancement in the future.

The College welcomes you, then, with the most cordial feeling and with the greatest satisfaction, welcomes you to everything here; welcomes you to it because it is yours and not ours. The College regards itself as the charter of a great public interest supported by the State, cherished and nurtured by the labors, prayers and tears and the constant faith of many good men and good women.

We have just begun the erection, to meet our growing needs, of a large hall, which is to be a dormitory and dining-hall, and where I hope, next year, when you come here, as I trust you may, you will find here conditions that will permit us to entertain you.

We have named the hall after one of our earliest trustees, one of the original founders of the institution, who stood by it and encouraged it amidst the most discouraging circumstances. We have called it McAllister Hall.

Here, on the top of the mountain, on this central plateau, overlooking, as it were, the whole State of Pennsylvania, we hope to perpetuate the names of the men who have done good things and great things for their fellow-men.

The College will be open to you in all its departments, not only where you hold your own sessions, but everywhere. Many things will naturally lure you away. I understand that the main purpose of this gathering is for business, and I see that Mr. Martin has, with what seems to me great skill, prepared the program in such a way as to have the work of each session fully occupy the time; at the same time we hope you will find opportunity and time to take in some view of our regular daily life. It is going on to-day and will be going on each day. We assemble in the auditorium every morn-

ing at eight o'clock for a brief chapel service. During the rest of the day the libraries and class rooms will be open for your visits at any time, no matter what is going on. You need not ask permission of any one and you need not consider that you are receiving a favor, but rather doing a favor. If you do not find your way readily, you simply have to inquire and you will find our whole body of young men students, as well as members of the faculty and members of the board of trustees who happen to be here, will be glad to give you every possible information, and assist you in anyway they may be able.

I have been asked this morning to say a word as to the relation of the college to agricultural education; but I am warned that the program does not call for any extended remarks. That is one of those things you notice on the program, and you will see that there is no space allowed for my address, and I suppose it is expected that it will not occupy any space; there is simply a mention of it, and I suppose at 9.30 you go on with the first paper. I understand by that, that my address was understood, as I have suggested, to occupy no space, therefore, I shall interject it, light as it may be and slight as it may be, and if I can give you a single useful suggestion, it will be all that I shall expect. I shall be glad if at some future time, Director Martin will give me an opportunity to talk more fully; I was thinking that perhaps he would give me one session.

The thing I want to say is simply this, in as brief form as I can, and yet as seriously representing my best thought. Agricultural education is like any other education, and education at best is a complex problem about which the best minds in all ages have concerned themselves. Let us ask the question, What is education? You take a boy and a girl and in each there is a germ of life; I believe, and all my observation confirms me in the belief, that in the living boy or girl there are certain potent forces, certain powers which may be developed, and under kindly, judicious and reasonable training, may be so developed as to evolve what power there is there, precisely as if you were to give me a grain of wheat. There is a certain potency in that grain of wheat, and there is no more; if the grain of wheat is defective, you get a defective growth, so that if your seed is defective, your crop will be defective. You take a plant or a tree or a flower, and the whole principle holds. I believe it holds wherever there is life that there is a certain germ of potency which may be divided into large things and small things, and a great problem of education is how to provide for ourselves the required training, from the home up through the school—to provide these living forces with training that will give opportunity for the efflorescence, so to speak, and fruitage of whatever power there is.

Now, a false course of training represses the power just as if you set out a tree and then piled stones aronnd it, which would repress the growth of the tree; so of children. I do not need to carry out the suggestion further.

The office of education is alike for all hnman beings, so far as dealing with the inherent powers is concerned. Simply to train the faculties is not education; it is not education simply to acquire knowledge. Education means the training of the faculties; to acquire knowledge in such a way that the trained faculties can use the knowledge.

Not long ago I heard a story that illustrates this: Out in the mountains of Colorado there was a man engaged in pumping. A mining operation was going on, and the pnmp got ont of order. The man who had charge of the pump could not repair it. The superintendent could not repair it, and they got experts to come who looked it over, manipulated it a little, charged their fees and went away, bnt the pump broke down and refused to work just the same, almost as soon as the repairer had disappeared. Finally, there came along one of those curious geniuses that you find in every community, who has a particnlar knack of doing some particular thing. His specialty, was pumps.

You have heard of the doctor who said whenever he had a patient and didn't know what was the matter with him, he always threw him into fits, because he was death on fits. This man had this specialty of pumps. It happened that the engineer was an old acqnaintance of his, and he said: "Joe, I am glad to see you, for I am having all sorts of trouble with this pnmp, and Joe, you are jnst the man to fix it up." Joe said, "I think I can fix it all right;" so the engineer went to the superintendent and told him, and the superintendent said, "Go ahead, if he can do it, I will be only too glad to pay him for his services." So Joe went to work and in about an hour he had the pump fixed up so it worked all right. The superintendent said, "I am very much obliged to you; jnst make out your bill and we will be glad to pay you right away." So he made out his bill for $50. "Fifty dollars," said the superintendent, "why you didn't spend more than an honr on it. I want you to make out an itemized bill before I pay you." "Certainly," said Joe, so he sat down and made out a new bill: "Repairs to pump, one hour's labor, 50 cents. Knowing how, $49.50."

It was the knowing how that counted, and that is the essence of education. It is not simply knowing, but knowing how. Agricnltural education is knowing how to do things in agriculture; engineering edncation is knowing how to do things in engineering, and so on, and so on.

Now, there are degrees of education, and here in this College, as many others, we have begun down at the foundation. We have to get our roots, so to speak, struck into the soil, then we have to build up gradually and rear the superstructure on them, and the relation of one to the other is one of the important practical problems we have to meet all the while.

I conceive of a system of real education as very much under the figure of a tree. A tree strikes its roots into the soil and the more vigorous the roots are under ground, the more healthy they are, the better they support and nourish the whole growth of the tree; then those roots are all compacted, if you give the tree a fair chance, and those roots and rootlets contribute their force to produce one solid trunk, and that solid trunk gives your branches, your flowers, your blossoms and your fruit. Just so in education. There must be somewhere, down in the foundation of education, a rooting in the soil of elementary knowledge and then there must be somewhere a gathering up of that knowledge. That is the office of the college; to gather all that up into strong, compact, vigorous growth that we call the trunk of the tree. A college education is the trunk of education. Any system of education, high or low, under any guise whatever, which does not somehow provide for the systematic compacting of elementary knowledge, is a false system and never will produce strong and permanent results. The inference is obvious, that in agricultural education, therefore, we ought to have it in the public schools and we ought to have in the teaching ranks in our schools a corps of teachers capable of teaching the sciences of nature.

I spent my early life on a farm and I never was taught that there was any such thing as a law of life in the growth of plants, trees and flowers about me. I dealt with animals all my life and I never was taught that there was the slightest suggestion of any such thing as a law of animal growth, so with all that world open to me I never had a suggestion that I was a part of that world. Everything was done by the mere rule of three for the ordinary purposes of getting a living. You need not wonder that the average boy and girl under such conditions becomes dissatisfied with that kind of a life and wants to drop out of it. But if you once open to them the mysteries of the life about them and let them see that they, of all others, are the most favored with opportunities for learning in the life all around them, you make a new attraction for the life of the farm. I hope we shall be able to contribute a very large amount of education to that end during this session, as supplementing the work in the public schools.

We have not been able, heretofore, to do anything like it in this field what we have desired to do, what I hope we shall be able to do hereafter, but we have made a beginning, at least, after an eight

years' struggle with the Legislature. We have the recognition of what the farmers of Pennsylvania demand, and what they need. We have a dairy building, said to be the finest in the United States. We did not aim at that; we have never aimed at that specific thing, but merely to have something worthy of Pennsylvania, believing that there is nothing too good for the young men and women of Pennsylvania, and so we have begun with our dairy building to obtain as good and as great an insight into the subject of dairying as modern science and modern discovery can afford.

I want to say to you that the agricultural interests of Pennsylvania owe an immense debt of gratitude to Dr. Armsby and Prof. Watson and Dr. Frear, who planned so carefully and so laboriously and did so much in securing this building, and to Col. Woodward, of the Board of Trustees, who gave of his time, without compensation and without any question of reward, unflinchingly, to start these great buildings. I might mention other names, but it happens that Col. Woodward was the Chairman of the Board of Trustees, so that, without his knowledge, I take pleasure in naming him here.

In the last Legislature, we asked for an increased appropriation for the maintenance of instruction in the Department of Agriculture, but we were unable to secure it. The answer was, "You won't need that until you get your new buildings." We propose to ask for the same thing this winter; that is, we propose to ask for an increased appropriation for instruction in agriculture, and we propose to throw weight upon these short courses which will tempt boys here a few weeks or months, then let them go back to the farm and come here the next winter, and so on, as long as they will come.

I have personally, privately and publicly bent by best energies to the building up of that kind of instruction without neglecting the higher and more complete instruction in the Pennsylvania State College.

I want to say just one other word, and here I must close. I have spoken already of the relation of agricultural communities to the urban or city communities. Some of my friends differ from me perhaps in my conception of what education ought to be in a republic; but I have a very strong conviction that the instincts of the people are better than the logic of the schools, and after all our talk of what education should be, there is a growing development of the instincts of the people, our great democracy, in favor of providing such an education as is needful for the uses of that democracy.

Let me explain: You go back in history and you will find that the ruling class, whatever it has been, has generally agreed and has taken care to keep education within its own control. Go back to the days of the Jewish theocracy, and who controlled education there? There

were no such things as public schools or private academies or normal schools. There were a few higher institutions where the select few had their special training under the direction of the Jewish priesthood. Wherever the Roman Catholic church had control, it has controlled higher education. Whenever the aristocracy has had control, it has controlled higher education. A student that did not belong to the Church of England could not get into the University of Oxford or Cambridge. That barrier is being broken down, as all other barriers are being broken down, but nevertheless, it emphasizes my proposition that the ruling class, as is shown in history, has usually taken care to control higher education. In this country the ruling class is the people; the great democracy. They should keep within their own hands the instrumentalities of education, lower as well as higher, so that every poorest boy can have, by the aid of study within his reach, as good an education as is open to the wealthiest and the most favored.

Unless we have that system of education, the control of all our public affairs would pass into the hands of the specially favored classes, therefore, I regard our public schools, our normal schools and State Colleges, as the instrumentalities to which we must look to secure to us and those who come after us, these great benefits.

Now, ladies and gentlemen, I must ask you to pardon me for taking so much longer time than I had intended, and with these disconnected and desultory but earnest remarks, because they express the deepest conviction of my life, and I learned it from a godly and patriotic mother, I must conclude. We are working out here not only a means of livelihood, solving the question of bread and butter, but we are working out a part of the great problem of modern civilization, especially as affecting the question of human liberty, so that I never can look upon a gathering of this kind, or in any branch of education, without thinking of it, with regard to these larger problems.

Again, I bid you a most cordial welcome here, and trust that the gathering will be not only full of ample profit now but will lead to many similar gatherings in the future.

The CHAIRMAN: The response will now be made by Mr. Alva Agee, of Wooster, Ohio.

Mr. Agee made the following response.

RESPONSE TO ADDRESS OF WELCOME.

By Mr. Alva Agee, *Wooster, Ohio.*

Mr. Chairman, Ladies and Gentlemen: The privilege of a response came to me unexpectedly a few moments ago. While thanking President Atherton for his kind words of welcome, I want to say for the farmers everywhere that we have learned to feel at home at our agricultural colleges. We have learned to come to the college experiment stations for all the facts that we need. Now that was not true twenty years ago. I do not believe it was hardly true a dozen years ago. We, as farmers, didn't know there were facts here that we wanted. We hardly realized what attitude these scientists presented to us as working farmers; but that day has changed, and it seems to me one of the best facts that we can present, that to-day all over this country the progressive men among the farmers are the true friends of the agricultural colleges of their states because they have learned that through these colleges they can obtain that which they need in their own life-work. I recall the fact that as a farmer I had gone to my own experiment station for one thing concerning the crop that I am most interested in, that was worth many hundreds of dollars to me, and to the experiments at State College I owe thanks for information as to another fact, that I converted into hundreds of dollars on my own farm. We are, therefore the friends to-day of the agricultural colleges and experiment stations.

Now, friends, the pleasantest thought that came to me in that address of welcome, was the public assurance of President Atherton, that I received from him Monday in private conversation, that the State College proposes, as soon as we give it the money, to put in a course of instruction that would fit our youth who propose to return to the farm to live.

President Atherton well says that we must train our youth to go into the cities and cope with those in the cities; but the great need to-day over this country of ours is not so much the recruiting of the cities as it is to revive and save our agriculture. There is serious danger that our lands are going into the hands of large and absentee landlords, that the brighest farmer boys are going to go into more lucrative life-work, and we want here, at State College, a course of

training along the lines needed just as we want it at the University in Ohio—a two or three years' course of study— just such as Dr. Atherton has outlined, where your boy and my boy can go after he leaves the high school and get some short course in agricultural education, so that they will know about the conformation of animals, so that they can be successful in buying and selling and know about feeding, where they will be instructed in such a practical way that they will understand the soil, and know how the soil should be treated, when it is in need of humus and what its conditions require, where they will have instruction all along these lines and then go back to the country and win.

Up in Minnesota, I found 530 students receiving instruction who propose to go back and who will go back to the farms to be winners. Your neighborhood as well as mine needs young men like that. Dr. Atherton says that the thing he looks forward to to-day is just the completion of this agricultural building, and then funds for maintenance in order that he can offer to us that course of study; and, farmers of Pennsylvania, you cannot do a better thing for agriculture to-day than to support in the Legislature and to demand that they give us just that course of study. We can't get it until we have a building to house it and money for its maintenance. It is going to come in Ohio and in Pennsylvania and in other Eastern states, and when it does, there is going to be a great redemption for agriculture.

One more word. Friends, it is to the Experiment Station that we look still for the facts we need and for the elevation of agriculture. How can you expect that Experiment Station to do the work that needs to be done here when there are not sufficient funds to put specialists in charge of each department of the work? You will see that without sufficient funds it is practically impossible for Dr. Armsby as Director, or for President Atherton to accomplish what is needed. We should have a complete course in Agronomy and a sufficient corps of experts at the Experiment Station to do the work which ought to be done.

You will see that that dairy building cannot do the work that you Pennsylvanians need to have done unless you have the funds for the employment of the best experts. I do not mean that you have not some, but you are crippled in that department right here to-day for want of funds to give you such an experiment station as Pennsylvania needs. Now what do you want to do? Why, go to your State Legislature and demand maintenance for this college to that extent that we can have those courses of study for the boys who are going to remain on the farm; if we expect them to remain there, we must have them.

Dr. Atherton also said to me privately that we need teachers in agriculture. We have got to have that four years' course that will

make professional men, and a corps of competent teachers, and side by side with that, we need that short course for our sons and daughters who will return to the farm, and President Atherton is desirous to give it to us. It is only a question of some dollars from a Legislature that has millions upon millions to appropriate. Pennsylvania has done a great deal, but there is much more to be done, and so I say we farmers should get together and demand that this appropriation be made. I am glad to-day that there is nothing else left to be done except to demand an appropriation. With a Department of Agriculture at Harrisburg that has given us such an efficient administration, and is doing so much for the farmer throughout the State of Pennsylvania, and with the State College so willing, it seems to me that the future of Pennsylvania agriculture is bright indeed.

The DEPUTY SECRETARY: During the opening session at Bellefonte, Dr. William Frear was to give instruction on "Soil Improvement." Dr. Frear was called away on important business and could not be present. He consequently prepared a syllabus of this lecture which is available and will at some time be distributed. I am satisfied that the entire audience will appreciate the study of this syllabus, although we regret very much that we are denied the pleasure and privilege of receiving it from the hand and mouth of Dr. Frear.

While I am on the floor, I will state that there will be a change in this program. Thursday night the exercises will be held at State College, in this room, instead of Bellefonte, for the reason that we have illustrated lectures. Both Dr. Crosby and Prof. Surface have illustrated lectures with lantern slides. All the apparatus is there for that purpose. The train carrying us to Bellefonte will remain until after the exercises close and convey us back. There may be some other changes which we will note from time to time.

DR. ATHERTON: Prof. Butz has been asked to act as Chairman on the Committee of Arrangements on behalf of the faculty, so that any of you who want anything, go to Prof. Butz. I don't know whether that applies to his bank account, but he is responsible.

I want to say that this winter we can take care of a hundred boys in creamery and dairy work, and at least fifty in short courses in agriculture. We want word to go abroad from here that Prof. Watson, who has had much correspondence in reference to these short courses, will be glad to hear from any prospective students in those lines.

The CHAIRMAN: The next thing on the program is Section A. We will now hear from Dr. H. P. Armsby on "Animal Nutrition."

Dr. Armsby made the following address:

ANIMAL NUTRITION.

By Dr. H. P. Armsby, *Director, Experiment Station, State College, Pa.*

*PROGRAM—SECTION A.

Mr. Chairman: I have taken up the question of "The Protein Supply of Dairy Cows" as my topic because the subject of "Animal Nutrition" is too large for treatment in one hour, therefore, with the consent of Director Martin, I will take up this single topic. In the first place, take a simple case. Suppose you do not give an animal any food at all, pasture it for a time, we find if we examine the excreta, that it is still breaking down the protein of the body. We find the urea and the other substances which come from this breaking down of the substances still present. In other words, that means that the necessary operations of the vital machinery used up protein and if you let the machine run long enough without any protein to make good this wear and tear, it will break down, that is to say, an animal can be starved to death by leaving out the protein of its food while giving it plenty of other material, just as if you supply plenty of coal under the boiler of an engine, and neglect to supply any iron and steel for repairs until it wears out. The engine will run for a time, run longer than the animal, but ultimately will break down. A certain amount of protein in the food is absolutely necessary to the vital machinery in repair. A minimum of protein is essential for maintenance, that is, you must have a certain amount, not a very large amount, to keep up the repairs, so to speak, of the animal; to make good the protein that always will break down, and the breaking down of it you cannot prevent by any sort of advice. You must have a certain amount of protein to maintain the animal.

Now, what happens if we give it more? In the mature animal you might think, at first blush, that if you give it enough protein to maintain its tissues that you would produce more lean meat in the animal. As a matter of fact, you don't. If you give it more protein it simply breaks down, and you get a corresponding increase in the

*Note.—The program was arranged in two sections. Section A and Section B. The two classes were scheduled to meet at the same hour, Section A in the main room and Section B in room 121. The proceedings are arranged under the different sections.

amount of waste product excreted in the urine. You cannot cause the mature animal to build up tissue or lean meat in the body by giving it more protein in the food. It will simply break down; all the nitrogen will be disposed of in the urine of the animal. The best you can do is to have this nitrogenous residue used just as you might use starchy matter or fat; in other words, what practically happens is, when you feed more protein to the mature animal than it needs, you are simply using that protein for fuel, and you don't get any constructive work out of it. It simply serves either to run the animal machine for the time being, or it may be stored up as food and used in that way at some future time. In this respect, I am speaking of the mature animal.

In the case of a young animal, or a milking animal, we have a somewhat different state of affairs. As I said, with the mature animal all the protein practically that is in the feed goes out in the excreta, that is, if the protein breaks down.

With the young animal, on the other hand, there is a possibility of storing up extra protein; with a very young animal, there is a very strong tendency that way. There were some experiments made a number of years ago on a calf about a week old or so. That calf ate, in proportion to its weight, a large amount of protein in the milk which was given to it and stored up about seventy-five per cent. of that protein, while if the same amount of protein had been given to a mature animal, it would all have been broken down practically, that is, the young, growing animal has a use for this extra protein in building up its tissues, consequently, it is safe to feed it more, because it can store up this extra protein. As it grows older it gradually loses that power; when it is a month old it stores up less protein; when it is two months old, less still and so on.

In the young animal, then, a certain excess of protein in the food can be used. There is a place to put it. The same is true, to a degree, in the animal that is producing milk. We all know that milk itself contains in the neighborhood of three to three and a half per cent. of protein, chiefly in the form of casein. In this respect, then, the milking animal is somewhat like the young animal, that is, in reference to using an excess or a larger amount of protein in its food for constructive purposes than the mature animal not giving milk.

We come now to something a little more definite, the bearing of these general facts upon the subject of the necessary protein supply of the dairy cow. How much protein does a dairy cow need? To answer that question, let us consider, in the first place, what she needs it for, in the light of what I have said. Like every other animal, she needs a certain amount for maintenance, a certain minimum amount to keep her vital machinery in repair and make good the waste. That amount has been found to be in the

neighborhood of six-tenths of a pound for a thousand-pound animal. From somewhat extensive experiments that have been made both here and elsewhere upon this point, we have, as a net result, this amount of six-tenths of a pound for the thousand-pound animal, and I think we may say safely that this amount is ample for such an animal. It is possible that somewhat less would answer, but we are reasonably certain that that is enough. We may say then that the ration of our dairy cow must contain six-tenths of a pound of protein.

Now, in addition, there is the casein and albumin in the milk which can be made out of the protein of the food. Now we can figure up that, approximately, without any difficulty. It depends of course upon how much milk our cow gives. Let us take a moderate yield of twenty pounds of milk a day, not a very heavy yield; the amount of protein in that milk, will vary somewhat, of course, according to the breed and individuality of the cow and the quality of milk that she gives. In a general way, we can say, that about one quarter of the dry matter in milk will be protein; that milk contains, we will say, thirteen and a half per cent. of solids, that would be equivalent to two and seven-tenths pounds of protein per day, one quarter of that being .675 pounds of protein. Under these assumed conditions, then, it is evident that we must have in the ration of that cow a little less than seven-tenths of a pound of protein simply to make the protein in the milk because the animal body cannot make protein out of anything else. We also must have 1.275 as the least amount of protein that that cow can get along with. It requires .6 of a pound to maintain her body or tissues. Since there is this amount of .675 in the milk, we must supply that much in the food if we don't want to draw upon the body. This would represent the minimum. If we suppose that cow to give thirty pounds of milk with, say 15 per cent. of solids, there would be four and a half pounds of solids a day and a quarter of that would be .125 pounds of protein approximately in themilk; andadd six-tenths to that, you will have .173, in round numbers. So the protein supply would depend on how much milk she is capable of producing. You strike there a very important idea, namely, the modification of the ration in accordance with the capacity of the cow. There are some other things to be taken into consideration. This protein—take this example—is chiefly in the form of casein with a little albumin. Now we do not give our cow casein or albumin in her food; we give her proteids which are similar, but not casein and albumin.

Now as to the matter of waste, it is somewhat as if you were to take down a shed and re-build it in a different shape in a new place. You could not do that without some waste material. There would be some pieces that would not fit in the new place and there would be some waste material. It is probable something the same is true

with this amount of protein in the body which is made out of food protein, but it is altogether probable—I am talking probabilities now—it is altogether probable there is some waste in the process, and if that is true, we have to increase that amount; how much we have as yet no means of saying. That is a sort of speculation.

Now, in addition to this, there is another very important question, and one which has been the subject of a good deal of discussion and one to which I expect to devote the rest of my time, and that is, Does excess of protein have any tendency to stimulate the milk production? Let me make that plain. We calculate that this supposed cow of moderate capacity needs at least 6 per cent. of protein and may be a little more, on account of this allowance that has to be made because of changing from food proteids to body proteids. She needs at least this much of protein in her daily ration. If we give her more than that—two pounds instead of a pound and a quarter—will that extra three-quarters of a pound stimulate her to produce any more milk? Will it make the milk-making machinery work any more readily or efficiently? It has been quite generally believed that it does. As you know, the German feeding standard calls for about two pounds of protein per day for a good dairy cow, and the so-called western standard of average dairy practice with a large number of good feeders calls for about two pounds and a quarter of protein per day.

You can readily see from these figures that that must be more than would be required for the maintenance of an average cow and for the protein actually found in her milk. Now the question is, I repeat, Does such an excess tend to stimulate the milk production? Or it may be put in another way, and frequently is. We have been accustomed to speak of the nutritive ratio of our various foods. Given a suitable amount of digestible matter or food material by increasing the nutritive ratio will it stimulate the production of more milk? It is generally believed that that is the case. We have been taught that the dairy cow requires a narrow, nutritive ration; a good deal of emphasis has been laid upon that, and rightly; the protein supply is important. It is possible, however, that we have a little exaggerated the necessity of it and at any rate I think we can get a little clearer view of the subject if, instead of talking about the nutritive ratio, we attack the problem on a little different side, and speak, as I have done already, of the actual amount of protein required. The cow needs something besides protein and we have got to furnish enough of the other required material to keep the animal machinery running; but for our present purposes we can state the question I think more simply by saying that so many pounds of protein are needed per head. On this point, I am going to present first, the results of a few experiments. The first one of these results is recorded in Bulletin No. 132

of the New York Agricultural Experiment Station and some of the results I have attempted to reproduce in a simple way on some diagrams which are also tabulated in these printed tables. The results shown in Bulletin No. 132, are the results of an experiment instituted primarily for another purpose. The protein supply varied considerably as shown in Table I. The first column shows the number of the period and the second the number of days it covers. The third column of this Table I, shows the total amount of digestible matter contained in the food, so far as it was determined; the next column the number of pounds of protein. The cow weighed, as you see from the statement, about 870 pounds, so her body maintenance requirement was about half a pound. Now, if we subtract from the digestible protein food this half pound that this cow required approximately to maintain her body tissues, the remainder will show how much is available for milk production or other purposes. These amounts are given in the column headed, "Protein less Maintenance," and you see the variations were quite considerable, ranging from 1.35 in the third period down to nothing, and a little less than nothing in the fifth period, while the total digestible matter did not vary so very greatly. It runs this high in the first period and in the second and fourth it is about the same. In the third it was not determined.

So far as the testimony of these two experiments would seem to indicate, it appears that below a certain limit the protein supply does affect the yield of milk, in this experiment particularly, where the available protein gets below 125 per cent. on what there is in the milk we are apparently getting a falling off in the milk yield. These three periods show a very wide range of the protein without much obvious effect upon the milk production, but when we got down here (referring to diagram on black-board) it is falling off evidently a good deal. Somewhere in here we pass the limit below which we begin to get a falling off in the milk yield due to an insufficiency of protein.

If we were to take the testimony of these experiments alone, then we should be inclined to say that if we let what I have called the available protein—that is the protein minus the maintenance supply—if we let that fall below about 115 to 125 per cent. of what we may fairly expect in the milk, we shall get a falling off in the milk yield. Some other experiments which I shall present, however, may incline us to modify that view a little.

Table No. 3, is an experiment at the Minnesota Station of a more practical nature than the two that I have mentioned hitherto, taken from a very carefully kept record of a dairy herd of that institution, divided by Prof. Hecker, who is an expert dairy feeder. He divided his herd into three lots, each lot got fourteen pounds of total nutrients, but with quite varying amounts of protein as you will see in Table No. 3. This experiment I think is particularly interesting

from the practical nature of it, and the fact that it was conducted by a man who has a national reputation as a skilled dairy feeder.

I come now to ask your attention to a few experiments which he made at this station bearing upon this same point under the immediate supervision of Prof. Hill, whom many of you know. (This was explained by means of a diagram on the black-board).

Now, in this last experiment, if you will compare the figures for available protein with the protein of the milk in the second half, you will see that in the middle period of this last experiment we got about down to the amount of protein required for the actual protein in the milk, that is, there was no excessive protein to stimulate milk production, and yet we got almost as good results so far as we can judge, by comparing them in this way, that is to say, there is no clear evidence in this set of three experiments that the extra amount of protein received by Lot 1 or received by Lot 2 at the beginning and end had any material stimulating effect. The cutting down in the protein seems to have resulted simply in diminishing the amount broken down while the milk production seems to have gone on, so far as we can judge, at a normal rate.

With each of these experiments, we also had a sort of an experiment within an experiment. We took one pair of cows—one out of each lot, and in addition to the general experiment, we collected the excreta and made a very careful analysis so as to determine just how much waste nitrogen there was; and without attempting to go into the details on that technical part of it, it is sufficient to say that it substantially corroborated the conclusions drawn from the more general experiment. We found in this last experiment, for instance in Lot 3, that there was just about enough protein in the ration to supply the maintenance demand in the body and an equal amount of protein in the milk. This dotted line here and black line represents the result in this case upon this single animal; it is almost exactly parallel to the result upon the whole lot, furnishing in that respect a check. To check up the matter still further, I have computed in each of these experiments the results and they are tabulated and found on Table 7, and are represented also on these diagrams. Here is the first of it; there is a good deal of irregularity in that. Curiously enough the lines are further apart here in the second and fourth period than they are in the middle period. I think this means simply that we gave a little too much feed in those two periods and they were probably putting on some fat on their backs. Here are the results tabulated in the same way for the second experiment; you will see the black line and red line run pretty close together; no very clear difference in the efficiency of the feed in the two cases. In the last one there is some bowing down or sinking of the line, indicating a lower efficiency. It is true to about the same extent in

one lot as in the other. If we had run only the one lot and compared them in the ordinary way, we should have concluded that the protein did make some difference in the yield of milk in the middle periods where we cut off some of the protein, we didn't get as much milk but we found that whatever was the cause of that, it was not the diminishing of the protein.

In this experiment there appears a little greater falling off than there should be in that middle period. It was a very wide, nutritive ration and very low protein-content. On the whole, I think, the clear teaching of these results is, as I indicated in the beginning, that perhaps we have overestimated the importance and overstated the amount of protein necessary for the dairy cow; I say perhaps. In one point of view, I ought to give you something that is certain. I feel, however, that one of the important functions of a gathering like this is to get these gentlemen who are to act as instructors to thinking on some of these problems. I do not conceive it to be the function of this Normal Institute to simply fill you up full of something that you are going to pour out later. The function of the institute worker is essentially that of a translator, to see how these principles have been worked out and applied, not to act simply as a vehicle of transmission, but to think on these questions, and to work out his own conclusions and his own best judgment to his audiences, and so it is not felt that it was out of place to bring forward a question which cannot be answered perhaps categorically and absolutely. I think we are safe in saying, however, that a dairy cow does not need very much more protein than is equivalent first, to what she requires for maintenance, and second, to what she will normally put into her milk. Any good dairyman knows how much he can expect from a cow—how much protein he expects that dairy cow to give him in the milk-pail. He can add to that the protein required for maintenance, and I think he won't need to go very much beyond that to get a sufficient ration so far as protein is concerned.

As I suggested, this matter has been discussed a great deal from the standpoint of nutritive ratio, so-called. It is not a question primarily of ratio; it is a question of amount. Suppose I feed my cow—my herd—with a moderately wide ration. If I make up that ration of foods that are not very palatable, the cow does not quite like them, and so feeds rather lightly, or I don't give her quite enough, she may fall short on protein. But if I take another ration just like that in nutritive ratio, but on which the cow feeds liberally, she may get enough protein, all she needs out of a ration of exactly the same nutritive ratio; you avoid that ambiguity if you consider how many pounds of nutritive protein you have got to supply and I can't see that it is going to aid much if I neglect that ration by putting extra carbohydrates in that ration. I think, in general, we have

a little over-emphasized the fact of a protein supply. I do not mean to say that we can feed a dairy cow successfully on timothy hay and corn meal. We need a certain supply of protein and we need more protein than is contained in a good many farm crops. I feel from the testimony of these experiments that if we take care to make our ration palatable and keep the cows in good condition—because if you feed the wide, nutritive ration and keep the cow out of condition so that her hair stands up this way (indicating)—it is not fair to ascribe her condition to the lack of protein. I believe your ration should be made palatable, and I believe we do not need to be quite as anxious about protein as we have been.

With comparatively wide nutritive ratios in skilful, practical hands, in this last experiment of 1898-9, leaving out the middle period where it was very wide, all the others had a ratio of 85 or 83 and gave practically as good results as the ratio of 65; and if you trace that back, you can't get any very different result between a ratio of 165 and 135. This does not mean that our dairy farmers do not need to buy protein foods, but it does mean that a balanced ration is of importance. It means simply that perhaps we do not need quite as much protein as we thought. If a man who has good, palatable feed, if protein is high, if oil meal is high, he need not feel that he can't possibly produce milk because he cannot afford to buy those feeds. I think the indications are, if he gets to that point or a little beyond, he will be doing fairly well. It will obviously depend on the character of his herd; the more milk that herd is capable of giving, the more protein he has got to give them to produce it, and he has got to give more in the earlier stages of lactation than when the cow is drying off. He has got to have something like a sliding-scale. It comes back after all to the practical judgment of the feeder in the application of these principles.

I had intended to say just a few words on the sources of protein supply, principally as between the purchasing of feeds and the raising of feeds, but I see my time has expired.

The CHAIRMAN: We will now call upon Dr. Armsby to take charge of the Round Table.

ROUND TABLE—SECTION A.

A Member: What form of protein is best for farmers to use, or what should a farmer buy, when he is a raiser of corn, oats and wheat? Can we feed two pounds of protein per cow per day with safety and profit?

DR. ARMSBY: I don't think I can answer that question better than by referring you to the work of the New Jersey Station and particularly to their Bulletin No. 158, which gives a series of rotations of silo crops, supplying considerable protein. In general terms I can say, raise leguminous crops such as oats and peas or the soy bean or the cow-pea or alfalfa. Dr. Vorhees gives a list of fourteen different sets of crops; there they grow two and three crops a year on their soiling and plots and arrange them in such a way that they have a continuous supply of green forage throughout the year. We are working out that same problem here but we have not completed the work yet.

MR. M. P. HALLOWELL, Bucks County: Are pumpkins of sufficient use to the dairy cow to admit their culture and use with other feeds? Should the seed be removed before feeding them? Have they any protein?

DR. ARMSBY: Pumpkins are not particularly rich in protein and it would not pay to raise them if you wanted them simply for protein. I think some of the others would be a better judge than I whether it would pay to raise them generally; as to the seeds, I suggest you refer that to somebody who has had experience with that.

MR. HALLOWELL: We had quite a discussion come up about the pumpkin and I asked that question for information. Some man said that if a man would plant pumpkins in his corn, he would get a gun and go after him.

DR. ARMSBY: Pumpkins are a good dairy food, but not a source of protein particularly.

MR. BOND: I spent four years from time to time off the farm in the village and I resolved upon an experiment. I tied up a milch cow and the heifer for beef in the stable and I fed them both nothing at all but corn meal and pumpkins for ninety days and we didn't remove a seed, and we never had a more satisfactory supply of milk nor better butter than we had during that time. My wife packed it and kept it for six months and the beef heifer made the very best of beef, and she never drank but four gallons of water in the ninety days. The cow would drink a little water occasionally, about every other day. I think that entirely exploded the theory that the seeds were injurious to an animal. I would not discard the seeds; we are feeding them now, the sweet pumpkin by the bushel, with the very best of results.

PROF. HAMILTON: The statement I believe was made that the entire quantity of nitrogen that is taken in is excreted. Are we

to infer, therefore, that the nitrogen is not deposited in the muscular tissue and other organic matters in the body and kept there?

DR. ARMSBY: My statement was in regard to mature animals, that the amount given off was equivalent practically to that taken in. That is not necessarily saying that it is not temporarily deposited, but the balance is equal on the two sides, that is to say, the mature animal has no considerable capacity for producing lean meat tissue.

PROF. HAMILTON: If that is the fact, is it important, if you desire an animal to give a large amount of lean meat, to select a breed that has that characteristic?

DR. ARMSBY: Yes, and you have to make your meat very largely while the animal is growing. These experiments have shown that the rate of lean meat production diminishes very rapidly, and the tendency, as the animal grows older, is towards fat production.

MR. DRAKE: This first table, does that apply to all animals?

DR. ARMSBY: No, that applies to the least amount of protein required by a thousand-pound cow giving 20 pounds of milk a day.

MR. DRAKE: Does that apply to all animals?

DR. ARMSBY: No, that is for cattle. It is about .6 per lb. for a thousand-pound animal and approximated more or less in proportion to the weight; it don't apply particularly to horses, sheep and hogs.

MR. LIGHTY: Provided I would have a cow that would give a proportionately large amount of normal milk, would the work of production of that milk have anything to do with the best theory of feeding; would there be a requirement for a larger maintenance ration, or if my neighbor would feed a ration that would be very difficult to digest and that animal would have to work very hard to digest that, wouldn't that tear down some of the tissue so that the maintenance ration would have to be larger? Is that possible, or will that remain practically stationary?

DR. ARMSBY: That is largely a question of the way of looking at it. Undoubtedly that extra work would have to be supplied in some way or other; that would come largely, however, from the non-nitrogenous ingredients of the food or body.

MR. LIGHTY: I ask whether the tissues would be broken down by the work, or would they be replaced?

DR. ARMSBY: Probably not. If an animal is at work and doing quite severe work, the force for this muscular work comes from the non-nitrogenous ingredients chiefly.

A Member: To what would you attribute the falling off of butter-fat from 4 to 3½ per cent. under same condition of feeding?

DR. ARMSBY: I do not know how it is possible to answer that question without a knowledge of the conditions. It is an abnormal thing, the tendency being rather to increase than decrease. I should take it that it indicated some abnormality either in the health of the animal or its surroundings in some way.

A Member: A change from one stable to another or frightening with a dog or some condition of that kind will do it.

A Member: When a cow's udder becomes inflamed through the influence of feed given, what is the remedy, allowing the feed to progress to keep up the milk-flow?

A Member: The first thing, if the trouble is due to wrong feed, the first thing is to change the feed. You have got at the same time to work on the udder to get out as much as possible the inflammation; but if you have been feeding the cow too heavily with cotton-seed meal, and have got her system all fevered up through that unnatural, heavy feeding, the first thing is to cut down on that feed, take away the cotton seed feed and give bran mash or roots, or something of that kind, that will cool off the body of the cow and then start in and give her proper feed.

SECRETARY MARTIN: Does the source from which the protein is derived, affect its value as a food?

DR. ARMSBY: As ordinarily measured, it unquestionably does, because protein from straw is a very different thing from protein from oil meal or bran, different chemically, undoubtedly the source of protein does affect its value. The protein for example for straw or hay, coarse fodders in general, is not quite the same thing as the protein from oil meal or bran. It contains more of these materials that I call non-proteids, things that have nitrogen enough but are not proteids; they have the protein along with other things. Coarse feed appears to be harder to digest, involves more labor of the organism, the point to which Mr. Lighty alluded just a little while ago, so that we cannot say they are equally valuable. Probably the protein of coarse fodders is not as valuable as that from grain.

PROF. COOKE: In making that statement can you use the non-proteids in making that estimation that you did on the board of the amount of protein? (Referring to diagram on black-board).

DR. ARMSBY: If you had asked me that question a year or two ago, I should have said you should leave out corn. But there have been some results published within a year or two, showing that an animal can build up proteids on corn; there has been quite a revelation on that point within a year or two.

QUESTION: "Will the Doctor briefly figure out a balanced ration on the black-board?"

DR. ARMSBY: I couldn't answer that off-hand. That simply means to sit down with a pencil and paper and figure it out.

QUESTION: "What form of protein is best for farmers to use or what should a farmer buy when he is resorting to corn, oats and wheat?"

DR. ARMSBY: The best form for him to buy is the one that is the cheapest, the one where he can get his protein—the amount that he wants, for the least money. The difficulty in the application of that lies in the fact that in any of these feeds you get something besides protein. You can't go out into the market and get something that is merely protein and nothing else, so that it is not quite a simple problem in short division; but after making such allowance as you can for what you get with it, get the feed rich in protein at the lowest posible cost per pound.

QUESTION: "Can we feed two pounds of protein per cow per day with safety and profit?"

DR. ARMSBY: Unquestionably, if you want to.

PROF. COOKE: I would like to state one little experiment I tried some years ago to see whether any bad results would come from excessive feeding in protein instead of feeding the ordinary nutritive ration. I went way down to the narrowest ration, feeding the cow with alfalfa, hay, bran and linseed meal; those are the feeds most rich in nitrogen, making a nutritive ration of somewhere around one to three and feeding it alternately with the wider rations and feeding for several months. Some of the cows had that ration for over six months, and there was no trouble at all. The milk-flow kept up in excellent quantity and the cows kept up in weight; everything seemed to be all right as the result of that excessive nitrogenous feeding, so that I am inclined to state it something like this: That if the feeds are digestible and healthful, it does not make any difference how much protein you put into the animal.

DR. ARMSBY: I would like to call your attention to the fact that the first of these three experiments are right along this same line.

QUESTION: "What is the effect of the source of protein upon the amount required?"

DR. ARMSBY: That was practically Prof. Hamilton's question. I think we may fairly say, so far as we have any evidence, that the protein from the grain is substantially the same if it is equally digestible. In the case of succulent, soiling crops, it is nearly or quite as good as the grain. In the case of coarse fodders, it is probably somewhat less valuable.

PROF. HAMILTON: Do we understand you correctly when we conclude that instead of following what has been called the balancing of a ration which is one to six or one to eight, that the proper method is to give a fixed quantity of protein and then to add carbohydrates according to the appetite of the animal—for instance an animal eats twenty pounds of food a day, and another of the same weight with a better appetite eats thirty—that we make the difference in the carbohydrates, but that we give each of the other animals the same amount of nitrogen.

DR. ARMSBY: It would figure out to that if they were producing the same amount of milk. What I said was that I thought this was a simpler way of looking at the problem. What I should say in practical feeding, would be to make up a mixture of grain that I was pretty certain had enough protein. Theoretically, we could figure out a sliding scale. It don't seem to me to be practical in actual feeding to carry out that plan; what we should have to do would be to make a grain mixture or ration which we were pretty certain contained as much protein as the cow would probably require, and then vary the quantity of that ration according to the appetite of that animal. That would result, theoretically, in giving your hearty eater some excessive protein, but it would not hurt the animal, and we would better do that than try to introduce great refinement of calculation.

MR. HOWDEN: I would like to ask a question in regard to lice on steers in spring, or dairy cows. Is there any remedy through the feed to prevent that, instead of an outer application?

DR. ARMSBY: I don't know; perhaps some one else here does.

MR. McCREARY: I don't believe, if you give them lots of feed, that you will have any lice on them.

MR. HOWDEN: That don't go down with us. I have found them in the spring in warm stables and they have lice on them; they usually start on the shoulders. I heard Dr. Thomas of the Ohio Uni-

versity say at an institute that sulphur properly fed to a dairy cow was all right. I was not in the business at that time or I would like to have asked him a question, so that I might have learned more about what he meant; but I have been using sulphur in the feed, commencing along perhaps in December, feeding half an ounce to a cow, sometimes increasing it a little, and I have kept them off. Whether it has been to the injury of the cow in any way, I don't know. If anybody else has tried the experiment, I would like to know it.

PROF. MAIRS: I know that sulphur fed to animals in the spring will prevent them from being lousy; whether the sulphur kills the lice, I don't know. It probably comes out with the perspiration and is disagreeable to the lice, but as far as feed is concerned, I don't believe that changing the feed itself has any effect upon the lice, and I know that fat cattle in the best of condition will get lousy if they are in warm stables, and the surroundings are right above. I never heard of animals being injured by being fed sulphur, and I know a great many men who feed sulphur to their animals as soon as it begins to get warm in February.

A Member: I would ask the question whether they ever use the brush on the animals? We have been brushing our cows for some time and find it advantageous. I think the best plan is to purify your stables the same as you would with a hen-house.

MR. HOWDEN: It has been our custom every year to whitewash the inside of our stables, but still they get lice in the spring after it becomes warm.

Adjourned to 2.30 P. M.

PROGRAM—SECTION B.

State College, Pa., Wednesday Morning, Oct. 12, 1904.

The CHAIRMAN: The first subject we have this morning will be, "The Principles of Plant Feeding," by Prof. W. A. Buckhout.

The following is a synopsis of Professor Buckhout's paper:

THE PRINCIPLES OF PLANT FEEDING.

By Prof. W. A. Buckhout, *State College, Pa*

The cultivated plants are derived from the wild; and in spite of the changes which cultivation has developed and intensified, the general principles of plant physiology apply to them.

Plants stand between the mineral and the animal worlds. They derive their food from the mineral earth and the air, and in turn become the food of animals.

The roots of plants are specially fitted for establishing and maintaining a close and intimate contact with the particles of earth. They do this by their extensive ramification and, particularly, by their root hairs which are delicate prolongations of individual cells and are thus the active agents in the solution and absorption of the food substances of the soil.

The leaves are, correspondingly, specially constructed so as to present a large surface of contact with the air, and through their breathing pores, some thousands to the square inch of the lower surface, to take in the carbon dioxide of the atmosphere. Under the influence of sunlight and the green substance of the cells of the leaf, carbon dioxide is decomposed, the carbon retained to be used in connection with food substance derived from the roots while the oxygen is returned to the atmosphere, thus restoring its purity and making it better fitted for the use of animals.

The practical question is, How can the best conditions be maintained so as to secure the best growth of cultivated plants?

The ground should be put in good mechanical condition and of good fertility, so that the roots may penetrate freely and come in close contact with food materials. Particularly should a liberal and constant supply of water be maintained by irrigation, it may be, and by cultivation and organic matter which conserve the water supply by restricting its evaporation and loss.

The aim should be to secure a rapid, continuous and vigorous growth of plants. This will not only secure a better crop return, but will also give more resistant plants which outgrow and ward off weeds and diseases.

Protection against the various enemies of our cultivated plants can best be secured in this way.

Prevention is better than cure, and vigorous growth is the keynote in securing immunity from interference by weeds, fungi and insects.

Negligence in properly preparing the soil is the chief means for inviting the enemies of cultivated plants, and when attack has been fairly made it cannot be successfully resisted.

Success in growing plants of any kind comes from an intelligent appreciation of a few fundamental laws of growth, and careful attention to them at every step.

ROUND TABLE—SECTION B.

(Conducted by Prof. Buckhout.)

QUESTION: "How many times should a microscope magnify to be of use to study plants?"

Answer: The minute structure of plants can be satisfactorily studied only by the compound microscope, and then only after careful preparation of the parts examined. One cannot see into or through opaque parts.

The enlargement should be 25 to 150 diameters; some would call this 625 to 22,500 times.

QUESTION: "In what manner do plants select and store in fruit, variations in color and flavor, although growing in the same soils?"

Answer: There is no positive knowledge on this point and the result in a given case will be found not the same from year to year.

QUESTION: "Will the pruning of root hairs while cultivating stimulate or retard the growth of plants? Also apply this to the pruning of limbs of trees."

Answer: There are so many factors concerned in the growth of plants that such root pruning as results from cultivating may have little or no effect upon growth. The pruning of limbs is quite likely to stimulate the growth of the plants, but not necessarily, nor always so.

QUESTION: "How much plant growth occurs at night?"

Answer: Growth, in the sense of addition to the size and bulk of a plant, occurs almost entirely at night; but there would be no such growth were it not for the physiological processes which took place the preceding day.

QUESTION: "Do gaseous substances enter plant roots? That pungent smell from manure, does it feed the plant through the leaves?"

Answer: To a limited extent, if at all. Gases are generally taken into solution in water and absorbed by the roots of plants.

QUESTION: "Would a plant which is well-fed and turned into hay make a better feed than one which is not well-fed?"

Answer: Yes, always.

PROGRAM—SECTION A.

State College, 2.30 P. M., Wednesday, Oct. 12, 1904.

Meeting was called to order at the designated hour by Howard G. McGowan, Chairman.

The CHAIRMAN: Professor G. C. Watson was to take part just at this time on "Animal Breeding," but he is otherwise engaged, so that the only thing available under Section A, is Mr. L. W. Lighty, who will now read a paper on "The Farmer's Cow; Her Care,"

Mr. Lighty read his paper, which is as follows:

THE FARMER'S COW; HER CARE.

By Mr. L. W. Lighty, *New Berlin, Pa.*

When asked by the Director of Institutes to prepare a paper for the Normal meeting, I was at a loss to know why I, young as I am both in years and institute work, should be asked to occupy time on this important occasion; but since thinking carefully over the matter I am somewhat reconciled, as we all know, that while going to school (and this meeting is a school in every sense of the word) we not only study our lessons and listen to the lectures, but we recite and are subject to quizzing, hence for the next 30 minutes I will recite my lesson as I learned it since I have engaged in this farmer's institute work, and then during the following 30 minutes I will be subject to the quizzing of the old workers, teachers and

war-horses in this work. I hope they will all feel free to question and criticise what I may say, because I do not appear before you as a teacher, but as a student, and while I can impart little or nothing of value to my hearers, I want to get from them a rich fund of information and a multiplicity of improved methods so I may go before the farmers of the State very much better equipped to do my share of the great work of elevating agriculture.

The subject assigned me on the program is one of my regular topics, but in this instance I will not weary you with the details that might be called for in the average farmer audience but will simply give you an outline or skeleton of it with some of the why's and wherefore's of my sayings.

This institute work is comparatively a new departure and is just in the formative period, consequently every worker had to originate methods and plans of procedure from rather confused and chaotic data, though the results in our State have been a success beyond the expectations of the most sanguine. Still there are not a few tangles that need straightening out.

Personally, as I thought over this matter, previous to my starting in this work, I reasoned in this way: To run a farm successfully necessitates a careful previous deliberation or planning, and I have reason to think that the same is true in doing anything else successfully that is worth doing at all. I am quiet sure that it holds good in successful institute work. I believe every real successful worker very carefully plans a campaign, and then to the best of his or her ability hammers along that line. I am inclined to think that it is even more necessary to specialize in institute work than in farm work itself, yet there, practically, the specialist is about the only one who succeeds. Therefore, in planning for my institute work I did not try to cover the universe; it was too big, and I too little.

We speak of the farmer being land-poor. I fear that some of the institute lecturers are also at least field-poor in the same sense. When we try to cover horticulture, floriculture, apiculture, aviculture, pisciculture, market gardening, animal husbandry in all its ramifications, civil government, civil engineering (laying out and constructing public roads), domestic economy and general hygiene, and the whole wide educational field from the nursery and kindergarten to the end of the university, we surely have too much ground to cover. True, all these fields should be cultivated, but I seriously doubt if one man can give his best attention to more than one, or a few at most. Therefore, when I started on my mission I chose not even one whole field, but fenced off a little corner in the large field of animal husbandry, viz: dairy husbandry; but I found even my little corner too extensive and tilled only a part of that.

My first and basic lesson was entitled "The Farmer's Cow; Her Care and Feeding." As an introductory to the talk, I generally draw attention to the desirability and advantages of animal husbandry on the farm. This I do by practical illustrations, showing the value to our land of the by-products, left on the farm in the production of the commodities of animal industry; and more particularly do I try to show that the field for selling ability, skill or ingenuity is greater here than in almost any other line of farm work. (I always increase or decrease these illustrations through all my talks as time and circumstances seem to demand.) I then follow by trying to impress my hearers with the importance and necessity of every one, individually, studying himself, his environments, markets, etc., with great care before deciding on the particular line of animal husbandry he will give his best attention to.

Next, I hold up, very briefly, some of the advantages of beef production; and there I try to score a point by showing from experiment stations findings, intelligent farm practice and observation that the farmer who secures and uses the variety or breed of animals that will produce the cheapest, largest amount, best quality, and most salable beef is the largest profit-maker. I insist on this for a minute to make an impression, not that I want to speak along beef lines, but it will help me to make a deeper and more lasting impression when I present the other side. I now drop the beef cow and speak, by contrast, showing and illustrating the vast difference between the cow that makes the best and cheapest beef and the one that makes the most and cheapest butter. I then drop the contrast and briefly give the main distinguishing points and features of the dairy cow and recapitulate, briefly, the origin, development, breeding and caring for her in her native home. Right here I am always particular to pay my respects to the fellow that is always kicking about the weakness of the pure breds in general and the Channel Island cattle in particular, and saying: "We want the common or cross-bred cow because she is hardy and can take care of herself, etc." I at once admit that those high bred cattle, that have been cared for like children for many generations, can not be expected to be as hardy and robust as Rocky Mountain goats; but we are not keeping our dairy cows to draw a premium on their sinews and physique, but on their acquired power of food digestion, assimilation and transformation into dairy products. This point generally needs developing; it is one of the stumbling blocks with many farmers.

A few homely illustrations will best remove this delusion or prejudice: For example, I take my hearers for a few minutes to Holland and show them how, by patient, constant care, intelligent feeding and selection for a few centuries, one of our most noted breeds of dairy cattle was evolved. Then I might say, suppose we with our

modern civilization and shelter and conveniences, were to be at once transported to another sphere where we would be compelled to adopt Indian methods of living, would not the results be disastrous? Could we bear the exposure and hardship? The comparison is fair. Now right here lock up all your prejudice for you surely have some to lock up if you are a real dairyman. You have a preference for a breed, you may have stock to sell and you may have some special feeling against some other breed for some reason, but whatever you do, do not let your prejudice crop out before any audience, as the other fellow who loves the other breed and whose friends do the same will jump onto you and much harm and no good comes out of it.

The best methods of securing these desirable and profitable dairy cows is next taken up and developed from such a standpoint that it will be helpful, not only to the man who has plenty of money to purchase a working herd, but for every man present who keeps milch cows on the farm. This of course is one of the most important parts of the question under discussion. That there are typical and profitable dairy cows is easily demonstrated and that he ought to own them, the average farmer full well knows, but how to possess them with his limited means and information is generally the real puzzle. From my observation and experience, I am inclined to think that he does not want some one to come and tell him how he can do or how he shall do or how easy it is if he only half tries, but instead, he wants to have the experience of some one who has done it.

One of the most serious questions with me always was, how much personal experience as such should be incorporated in the talk. Do too much of it or do it injudiciously and the opinion will become general that you are boasting and are out on a trip to advertise your smartness. Go to the other extreme and the general opinion will prevail that your talk is theory, and if you were asked to work it out on the farm the bottom would drop out. I know this to be true in many cases and for that reason the question has bothered me more than a little. But as I worked out this problem personally under about as unfavorable conditions as usually confront any one, I am inclined to believe that the simple, unadorned story of my experience with a small herd of very common cows, on a patch of very poor land, with very little money to start with, and how by simple steps slowly but practically, with an investment of but very little money, I built up my herd to an average production of 368 pounds of butter in a year; I say, my experience in giving this matter in this shape seemed generally satisfactory, though I never feel quite at ease after giving it for fear of being accused of being out on a boasting expedition. But I have fairly convincing facts to back me up and a general standing invitation is extended to doubting Thomas's

to come and see, and as a result some hundreds have availed themselves of the invitation, and up to this time, so far as I could learn, not one accused me of having a model farm or a crooked story. The story, put very briefly, is that I weighed and tested each individual cow's milk, keeping a strict account and weeding out the unprofitable cows and later, the least profitable ones. When starting, I invested borrowed money, in a sire from the best producing stock in the country. A continuation of this process for some years resulted in a herd of quite profitable animals. Incidentally, I enumerate some of the advantages of keeping a tabulated record of each cow's work; it is in fact a pedigree of performance. I further urge the frequent use of the Babcock test. There is no better diagnostic agent at the dairy farmer's disposal than this little machine. I generally give some observed facts and telling illustrations of its practical value and insist that the milk-weighing scale and the Babcock test become an indispensible part of the equipment of every farm where dairying is to be part of the profit-making work. These two implements used carefully and constantly teach more lessons in successful and economical dairy management, than any one, who has never used them, dreams of.

All this follows in the natural order and sequence of the building up of the dairy herd and, concomitantly, with it arises many questions about housing and caring for the cows, which topics follow this one. Here it would be very easy to continue the method used in the former division, viz., personal experience, but for fear of my talk becoming monotonous the discussion is now directed to the elucidation of general principles; but to do this it is of course necessary to make some general applications and define results. It will be found somewhat mollifying and hypnotic to blame the other fellows for being guilty of slovenliness, filthiness and carelessness in the dairy. I find that by casting insinuations at the company present I would be stroking the fur the wrong way, get myself into trouble and do no good. But if I tell them that some folks, too far off to be present, do thus and consequently suffer serious losses, not only in low prices of product, disease and death of animals, but in self-respect and manhood, they begin to think there is room for improvement at least in their neighbors' stables. It is best not to be too dictatorial, but to make an extra effort to get our audience to thinking, because we must remember that in our school we are dealing with some pretty big and "old" boys who, like ourselves, are set in their ways and their habits are firmly fixed.

In speaking on this division of the topic, I insist on a few essentials or necessities, and to impress them thoroughly and show their simplicity, naturalness and practicability I use this familiar illustration:

When and under what circumstances do your cows do the best, give the most and best milk? In the beginning of June when you turn them into yonder field covered with a new growth of clover, a brook of sparkling water flowing along one side the banks which are lined with giant maples and sycamores, there we have ideal conditions and the cow never does better because these conditions make her do her best. Now, here is a lesson worthy of careful study and application. We should make the conditions in which the cow is to exist continuous as nearly as possible, the conditions she is in when in that clover pasture.

First, she has an abundance of food, palatable, nutritious, digestible, succulent, food that makes a fairly balanced ration. Thus far there is not much difficulty, as we can easily have an abundance of food, and if cut and cured properly it will be palatable, digestible and nutritious, and if the right crops are grown it will make a fairly balanced ration; or if it does not we can supplement by purchase of concentrates, and it is the easiest matter in the world to have some of it in a succulent condition. What next? Perfect comfort. We must not ask the dairy cow to do any unneccessary work because, in the proper performance of her task, the turning of a large amount of coarse feed into dairy products, all her energies are taxed to the utmost.

In that feed lot as soon as she has filled herself well, she lies down on the springy bed of sod under the old spreading tree and there, in perfect contentment, she manufactures that big pail of rich milk. Did you say she needs exercise? She ought to know. She does not gallop up and down that field after taking her fill; so I conclude that her regular work before mentioned gives her all the exercise she needs. Now for her comfort. Can we not so construct our stable and so keep it clean, and so bed her stall that she can, after eating her fill, lie down in similar comfort and manufacture the same quantity of milk? Certainly; this is easy. But out there in the feed lot she has plenty of the God-given, glorious, health-giving sunshine and pure air to breath; in fact, by an ultimate analysis, butter is only transformed sunshine. Now this is not so easy, but it is just as essential as anything else. Yet it is not so difficult to put plenty of east and west or, still better, south windows in the cow-stable in such a way that the sun will shine in about every corner for at least part of the day.

The question of pure air is still more difficult, because our stables, to give comfort, must, of necessity, be proof to a certain extent against outside temperature, hence if we would have pure air for the cow to breath we must make provision for the removal of the foul air and the bringing in of the pure air. This is not as easily done as said. During the cold season we have to depend for the warmth

in the stable on the heat given off by the animal body, and if our stable space is too large or we change the air too frequently we will have too low a temperature for cow-comfort. Up to this time our scientific men have not fully solved this problem of ventilation for us. Let me quote a paragraph from that excellent work by Prof. King, Physics of Agriculture. (Page 354), entitled "The Degree of Impurity of Air Permissible:"

"We are yet without sufficient exact data to permit this problem to be concisely stated for stables used for domestic animals. In the absence of exact data we have arbitrarily assumed that if the air is changed in the stable at such a rate that it at all times contains no more than 3.3 per cent. of air once breathed, fairly good ventilation would be provided."

Authorities also differ greatly as to the amount of air breathed in a given time; but in this matter, as in many others, we must use our best judgment. The book and the rule we need; yes we must have them, but without a good measure of good, solid "horse-sense" our undertaking will surely be a failure. Parenthetically, I might say here, that it is well sometimes to state before our audience that we really do not know it all; it inclines to let us down a little more gently. Still I believe it unwise to incorporate too many conundrums in a talk.

One more requisite, and that is an abundance of pure water. Did you notice in that pasture, even while not eating any dry food at all, the cows would go to the brook four, five or more times a day? When the cow is eating dry feed, as she does in the winter, she will certainly desire water as often, if not oftener. I do not insist that such frequent drinking is an absolute necessity, but as the cow thus preferred, when at liberty, I concluded that it was for her benefit and so arranged devices that allowed the cow to drink whenever she so desired, and if that tabulated record tells me correctly, all the expenses connected with it were more than paid the first year not considering the labor saved.

It should be remembered that the functions of digestion, assimilation and elimination can not do their work properly unless the supply of water is ample. The cow puts about 87 per cent. of water into the milk and if the water is scarce she just makes less milk, but if it is plenty, though she makes more milk she, unlike some dairymen, does not water the milk. All this tells us plainly that a large quantity of water is demanded by the cow daily and I find that a medium sized cow in full flow of milk on partly dry feed drinks from 12 to 14 gallons daily. This water should be pure for the sake of the cow's health and because she uses it to make milk that we drink, we should make an effort to have the water at about the same tempera-

ture as that was in the brook when she enjoyed it so much in June.

As this topic originally stood it included: "The Farmer's Cow; Her Care and Feeding"; but you can thank Mr. Martin for clipping off the feeding, otherwise I would continue to vex and worry you for another half hour. I have taken the hint and divided the talk into two lessons of about half an hour each and will so give them in the future. Long-winded speeches at farmers' institutes are an abomination: this is the mildest word I can use.

Now, in closing, let me recapitulate: The object of this lesson as given at the farmers' institutes is,

1. To emphasize the importance of animal industry on the farm.
2. To urge the farmer to more carefully study the relation existing between himself, his environments and his business.
3. To thoroughly impress him with the necessity of having actual dairy cows to do profitable dairying.
4. I try to illustrate how the average farmer can possess such cows.
5. I give a brief outline of managing and caring for them after he has them.

By the time I get to the end of fifthly, I see some in my audience beginning to yawn (just as they do now) and just then I find it wise and appropriate to stop.

The CHAIRMAN: Dr. Thayer, I understand, has not yet arrived. I am glad, however, that we have Prof. Watson with us. I will now call upon Prof. George C. Watson, who will present his paper on "The Principles of Animal Breeding."

The paper presented by Prof. Watson is as follows:

THE PRINCIPLES OF ANIMAL BREEDING.

By Prof. G. C. Watson, *State College, Pa.*

The papers that are now being distributed will be referred to in a few minutes; they will be used for reference during my talk to you. In preparing what I have to say to you this afternoon on the subject of animal breeding, I was at a loss to know what to say, taking into consideration the time allotted to me. When we come to consider the subject of animal breeding in its various phases, we find it to be very large, and I have been somewhat

at a loss to know what particular phase of the work would be of most interest to us or what we could discuss most profitably together. I have, however, decided to try and confine myself to a comparatively narrow phase of what might be called animal industry work.

As man began to study the breeding of domestic animals with a view to improving them for his purpose, he found that certain conditions tended to bring about certain results; that there were well-fixed laws governing their propagation. He found that nature did not depend upon any chance in perpetuating the various species of plants and animals with which he was familiar. By studying conditions and results certain laws have been formulated and have been accepted both by the breeders and the scientists. The fact is, these laws have been ascertained by trial; the laws of breeding have been found out by trial or by the results of many trials, rather. They have not been reasoned out by analogy, but have been formulated from general practices and recorded results. That is the way the laws or so-called recognized laws of transmission or principles of breeding have been determined. Of all the laws pertaining to stock breeding which we recognize, a few are considered to be of more importance than others. Practical men as well as scientists lay more stress upon some laws than upon others and it is these few that I shall try to call your attention to this afternoon.

The recognized laws of breeding are founded upon certain well-known facts or principles which are accepted, for we must have certain accepted facts as fundamental principles for a foundation on which to build our structure if we are going to arrange any system for a series of laws; and I may say that various authorities have formulated these principles according to their different judgments. We find that they are essentially alike but differ in some minor details. The laws which I have had printed on the sheets now in your hands were enunciated by Prof. William H. Brewer, of Yale University, whom I hold to be one of the best authorities on the principles of breeding in this country. These we may call fundamental propositions upon which the laws of stock breeding are founded. We will read them over together. As I have arranged them they are

SIX FUNDAMENTAL PROPOSITIONS.

I. Every animal must have two parents, and every animal resembles its parents in most of its characteristics. There is a force or tendency to keep offspring like their parents or descendants like their ancestors. This is called the "Law of Inheritance," "Similarity," "Like Produces Like."

II. No two animals are alike or identical in all respects; hence off-

spring are never precisely like their ancestors. This is known as the "Law of Variation."

It may seem as we read them, one after the other, to be somewhat paradoxical, but I think, on a moment's reflection, it will be seen that it is perfectly plausible that the law of heredity and the law of variation can both be in force at the same time. You may ask if the law of heredity is in force, how can the law of variation be also in force? We know there are animals that produce after their kind. We know that rodents have not changed at all since we can remember, or the change has been so slight that we do not notice any change, but the law of variation comes in because we know that two rodents are not alike. They distinguish one from the other. We know that the rodents recognize each other. They know the difference and we know that they know it. Squirrels in the forest recognize each other and so with other wild animals; they recognize each other.

III. Vastly more animals are produced than are needed for breeding, and only those having the highest aggregate of good points should be used to breed from. This is called "Selection."

IV. By training, environment and selection in pairing, the form may be modified and the relative value of the various points be changed so as to better suit the uses or the fancy of the breeder. This is called "Breeding to Points."

V. By breeding to points, the characters may be increased beyond what they were in the ancestry. This is called "Improvement of Breeds."

VI. The more uniform the ancestry in character and the more restricted in number, the more uniform and certain the resulting descendants. The converse holds equally true.

To the first two I wish to call your special attention. We must accept as fundamental propositions the self-evident truths or axioms in building our laws that we recognize as principles of breeding, and I have selected for special discussion the law of heredity and the law of variation, and if possible to discuss the effects of crossing or of mating the unlike in relation to these two laws.

It is a matter of common observation that the law of heredity pervades all nature; the continuity of the species depends upon it. It must be so for our species of wild animals and plants are fairly constant. Without this law the perpetuation of these could not be accomplished, and it is thought that this was the first law that men recognized—that it was the first recognized law of stock breeding, and from the earliest histories that we have we are led to believe that the ancients first recognized the law in their endeavor to claim some superiority from relationship—by claiming a relationship to a superior individual. They undoubtedly did that,

for we know that many of our stock-breeders to-day do not get very far away from that fact and are inclined to do the same thing at the present time. It is recognized by breeders and scientists that certain conditions tend to make heredity strong, that is, the offspring resemble the parents with greater certainty under certain conditions than they do under other conditions. Some of these—the more important ones—are the following:

First, purity of breeding in one or both of the parents when both are of the same breed. This of course would not apply if the parents were of different breeds or very unlike. I do not think it will be necessary to present many illustrations of this, though I will present a few. If we have a flock of mixed fowl and breed them to a pure bred male, a Plymouth Rock, if you please, we have almost without exception a flock of chickens that resembles the male in many respects—these fowls resemble the male very much more than the female. Why? Simply because the male is better bred than the female. He has come down through a longer line of pure breeding. He has back of him a longer line of pure bred ancestors. The same would be true of breeding various classes of domestic animals which man is now caring for; familiar illustrations of this kind are familiar to all of you I know.

Second, the length of time during which the ancestors have been bred pure is of the utmost important. A long line of pure bred ancestry is of a great deal more importance than a short line of pure bred ancestry. One illustration may be mentioned, the attempt of the French many years ago to improve their sheep. You perhaps know—probably all know that the English have made a very famous mutton breed of sheep they have bred for years famous mutton breeds of sheep, which have been noted for the fine mutton they produce. Many years ago a Frenchman thought he would improve the French breeds of sheep by crossing them with some improved English breeds. He tried it with no beneficial results whatever, or with very unsatisfactory results; the sheep all looked like the French sheep. The French sheep were hardy, long-limbed and poor mutton sheep. They were vigorous sheep, produced little wool, and they were very unsatisfactory for mutton production. He tried to improve them by crossing them with the improved English sheep—with the improved rams of the mutton breeds of England, but he did not get the improvement. The French sheep had been bred so long—bred pure so long—that their characters were so much more firmly fixed than were the characters of the English improved sheep, that they predominated in the offspring. Many illustrations like this might be cited to confirm the fact established among breeders that the length of time during which the ancestors have been bred pure, is an important factor.

Referring to our third proposition, the closeness of blood relationship in the parents, you may say that means in-breeding. I have distributed a sheet on which are printed two pedigrees; the first one, the pedigree of the Fifth Prince of Orange, a Holstein animal that was owned for a time by T. C. Maxwell, of Geneva, N. Y., that was produced from the attempt to breed without in-breeding with a limited number of animals in the herd. Of course the pedigree does not show it, and I will ask you to take my word for this that the ancestor of the Fifth Prince of Orange, as shown on the paper, showed a great variety of animals as to form, color, size and beef production. Some of them were very good beef animals. Some of them fattened very much more readily than others; some were good milkers and some were not. Some were large and some small, showing a great variety, consequently in the Fifth Prince of Orange we got a mixture of no particular thing. He was not a noted animal as a sire. He did not transmit his own characteristics with the certainty essential to a very valuable animal. I know there are some Holstein breeders in the audience and perhaps there are some present who know of this animal. I must say, in passing from this to take up the next, that this breeding was done by the Oneida Community. I do not know that you ought to expect anything else from such a source.

I call your attention to the next or second pedigree, that of Polonius, and represents in the five generations the blood of but two animals, and this shows you the line of transmission which was in a large degree the foundation of the St. Lambert family, and in this animal was secured, and fortunately without any deterioriation due to in-breeding, an animal that transmitted his own characteristics with great certainty, and it was just what we would expect from this kind of breeding. I have selected these two purposely because, while they are both pedigrees of pure-bred animals, yet one shows a great mixture as regards ancestry and the other shows marked uniformity. The closeness of blood relationship, then, is an important factor and the resemblance to parents in form, color, structure and function. If the parents are very similar, the offspring is likely to resemble more nearly the parents than if the parents are quite dissimilar.

For the present, we will pass to the next subject, the law of variation. Illustrations of this law are so common that they have come under the observation of all observing minds, therefore, it is hardly necessary to present these illustrations to show that this law is continually in force. Some may vary more and some may vary less. It is true of all organized beings, whether animals or plants; they possess a certain amount of flexibility or pliancy which renders

them capable of varying to a greater or less extent; but all organized beings may vary some. In the state of nature, with few exceptions, variations are comparatively slight, but in the state of domestication they occur more frequently and to a much greater extent. In order to see striking illustrations of this, we have but to compare various cultivated or domesticated forms with the wild forms, from which they are known to have originated. In the improved breeds man has introduced variation; man in his attempts to improve a wild species for his use tries to induce variation. If he cannot secure variation, the improvement must be very slight, so that variation is the thing that he tries to bring about first.

After he secures variation, it is a comparatively easy matter to direct that variation along the chosen or desired lines. The variation in domesticated animals is greater than in wild species, because the domesticated animals are not of as pure a breed as are our wild species and because the conditions under which they are maintained are not so uniform. The wild animals and plants are maintained under more uniform conditions than are our domesticated animals and plants. There is not only a greater mixture of blood in the ancestry, but our domesticated animals are given a greater variety of food. Breeders have learned that it is necessary to break up the long line of uniform conditions if they would induce variation. The history of the cultivated dahlia is an illustration of this. We now have under cultivation very many beautiful forms, very many sizes, colors and forms that have all come from one wild specie. This plant was taken to France many years ago, from Mexico; an explorer in Mexico found this plant and took it to France where it was cultivated for many years as a curiosity. They tried to improve it; they subjected it to superior cultural conditions; gave it a better chance, as we say. It grew a little larger, but the plant bore the same kind of single flowers, not very beautiful, and they had about given up securing any improvement when another traveler from Mexico took another variety of the same species to France. The botanists recognized the two as belonging to the same species, but were different; they were what we call local varieties. Then a florist took these two varieties, bred them together, and thus in a little while he got variation. He broke up that long line of ancestry and the tendency to produce after its kind. It was not necessary that the variation was in the right direction, but after a variation was once secured, then it was a comparatively easy matter to improve the plant or its flowers, and that is just what the breeder of animals will try to do. He will try to improve by securing variation, and by breaking up long lines of ancestry.

That is just what the Frenchman did—I didn't finish that story about the English and French sheep. He tried to improve by cross-

ing the French with the English mutton sheep, then he found that by crossing or breeding together different varieties of French sheep that resembled each other quite closely, that he secured a sheep differing in many respects. These he crossed with the English sheep, and got the desired result at once. He broke up this long line of uniform ancestry by breeding these three or four breeds of French sheep together, then he got good mutton sheep from the English bred sires.

In order to induce great variation there must have been a mixed ancestry. Variation does not come from a long line of uniform ancestry, but from ancestry that is greatly varied, particularly in the recent generations. Just in proportion as the breeding is mixed, whether in animals or plants, so is the tendency to uniform production lessened. It is also a fact that the male leads in variations. We see indications of variation or variations in the male, and we usually see variation first in the organs that pertain particularly to the male. In poultry, for instance, those organs that are peculiar to the cock will be found to be more largely developed than in the female, as in the comb, or wattles, and we should expect to see variation first in the male. It is thought that the female, in many of our domesticated species, has changed somewhat less from the wild form than has the male. Physiologists also tell us that monstrosities are more likely to be observed in the male sex, also that there are more likely to be male idiots than female.

In these few words I have tried to state a few of the conditions which tend to make heredity strong and also those which tend to make variation strong, or to induce variation. Now that we may see the application of this a little more clearly, I would like to discuss with you for a few minutes the principle of crossing, or cross-breeding. I may say that this term is often used rather loosely which leads to a great deal of confusion. In its strict sense, cross-breeding of course would mean the mating of animals of distinct breeds or species; that is, crossing the breed. Nature seems to impose a barrier on crossing species, although man has done this successfully in some instances, but he always has to pay the penalty, as nature imposes a penalty in crossing, particularly those species that are very unlike. Species as a rule will not cross, but if they do cross-breed, the progeny are not as strong and vigorous as the progeny of either breed, particularly after the first generation. The most natural attempt for a man to improve his stock is, to cross it with animals having the desired characteristics. Many men have attempted to do that and where the cross has not been very marked—where the animals have not been very unlike he has succeeded admirably. This may result beneficially, or it may result in great harm; it depends upon the breeds thus crossed or the mating through which the improvement is sought.

There is a prevalent idea that one animal with good qualities crossed with another animal with certain good qualities which are wholly lacking in the first animal, will produce offspring having the good qualities of both parents. We hear of that idea frequently at the College and I may say that farmers or breeders who attempt it are quite sure to be disappointed; it is very unlikely to occur. It is more likely to produce the bad qualities of both than the good qualities of either, or reversion may occur, that is the offspring resemble a distant ancestor rather than either parent. That frequently happens; perhaps all of you have seen illustrations of this kind. If you breed a white breed of fowls together and a black breed together, what are we likely to get? We are just as likely to get a copper-colored breed as black fowls or white fowls, or a mixed black and white.

Not long ago an educated man, a successful man along his lines of work, who was interested in agriculture, said to me that he proposed to cross the Jerseys and Holsteins, hoping to secure the good qualities of both. He could not understand why his plan was not a rational one to pursue; he could not see that the poor qualities of both were more likely to be transmitted to the offspring than the good qualities of either. Now, why is that so? You all undoubtedly will agree with me when I say that those qualities which are most likely to be transmitted to offspring are those that are common to both parents. The qualities common to both parents, or the characteristics of both parents, are the ones that are the most likely to be transmitted to the offspring. Where the parents are very unlike, the characteristics that are common to both are likely to be of a common or unimproved ancestry. Now what are you going to get when you cross-breed such animals, that are wholly unlike? Are you gonig to get the flow of milk of the Holstein and the quality of the Jerseys? Once in a thousand times, maybe; maybe once in five hundred; I can't tell. But you are not likely to secure it, so we have this deduction. If we are to cross with the greatest success, we should select animals that resemble each other, as far as possible, in the desired characteristics, in order to secure the desired results by crossing the breed that is to be improved; then, if what has been presented to you is true, one breed should be weakened as to its characteristics. If one breed has come down through a longer line of pure bred ancestry and the other has not, the pure bred breed is likely to transmit its characteristics to a much greater degree than the other.

There are instances where pure breeds that are quite unlike have been crossed and produced desirable offspring. It is said that the Plymouth Rock fowls were produced in that way by crossing the

Black Java hen with the Dominique cock. It is said that the Black Java and the Dominique cock were both pure bred fowls. This particular case is often quoted as a noted illustration—one of the few that can be mentioned, one of very few, and in this you will notice that the Plymouth Rock resembled the Dominique cock to a greater extent than it resembled the Black Java, and as the Dominique cock was the oldest and the best-established breed, its characteristics were transmitted to a greater extent to the Plymouth Rock fowl than those of the Java.

The most noted illustration furnished in crossing of this kind was that done by Charles Darwin when he bred together the White Silky and the Black Spanish fowls. The Black Spanish was thought to be one of the oldest and best established breeds that was bred in Charles Darwin's time. The White Silky also was an old well established breed. He bred these two together. He selected them with great care, and the result was that in the second generation he secured a form that resembled very much the wild Jungle fowl of India—the Gallusbankiva from which the domesticated breeds are supposed to have come.

My time has expired. I wish to thank you for your close attention.

The CHAIRMAN: It is thought best that Dr. Thayer should present his paper now, and then the Round Table will follow Dr. Thayer.

The following subject was discussed by Dr. Thayer:

FEEDS AND FERTILITY.

By Dr. I. A. Thayer, *New Castle, Pa.*

Mr. Chairman: I may say in beginning that I am going to occupy only a few minutes. It is not expected that I have come here to-day to teach any of you. This is a Normal Institute. I am talking to managers and instructors, and would not presume for a moment to think that I could instruct the instructors. My sole purpose is to call your attention to matters, in my opinion, of vital importance to the institutes which you will address, and it is going to be a rambling talk over a brief period. I have nothing logically

and systematically arranged, and I did not intend to so arrange it. The theme given to me is "Feeds and Fertility," and before we are through, we want to see the relationship between these two.

Four things are to be considered in the selection of feeding stuffs. I will call your attention to these and I want you to go out and give a special emphasis to it. It has been too often the case that we single out a single thing and feed with that single thing in view, and select our feed to that end. I want to say to you that it is important that we consider four things in the selecting of feeding stuffs. First, the product sought, whether it is milk or force or fat; whatever we are after, the first thing to do is to select the food that will produce most of that thing, and to vary of course, just according to the thing that we want. If it is milk, it will be one thing; if it is fat it will be another thing.

Now then, if we all take up this chart, and look down for instance, at the concentrates, just take that as an illustration, and you run along down to buckwheat middlings; that is on the last page there—buckwheat middlings, cotton-seed meal and all the way down through those by-products—and we find this, that in a ton of cotton-seed meal, we get 1,836 pounds of dry matter, and we want to know how much dry matter is in a ration, that is, we want to know this because we want to regulate our feeding by it; we find that there is in the neighborhood of 26 pounds of dry matter in a ration—for a suitable ration —1,836 pounds of dry matter and 740 pounds of digestible protein. Of course these things vary; I cannot stop to explain that now. Too many feeders stop right at that point. There is another thing that must be taken into consideration and that is the health of the animal, the physical condition of the animal. Now we have to go outside of what this chart gives, but we will know this, that if cotton-seed meal is crowded in the steer you get a feverish condition. If you are feeding silage, as you all ought to, that being loosening in its nature, then those two things go together very well, and the health of your animal is preserved. There is another thing you must take into consideration; that is, the cost of the food. In selecting food it don't do to feed a cow $50 worth of food and get $49 worth of milk.

Let us look at wheat bran. I assume we are looking at cost now; call it $24, I think that was the prevailing price last winter. You get 240 pounds of digestible protein in a ton of it. If you pay $24 for a ton, you are paying ten cents a pound for the protein; two pounds of digestible protein costs you 20 cents and then there will be the roughage; you want to keep that thing in mind all the time. It is a very helpful thing; it keeps the milk in good condition.

Now let us look what the others cost. Cotton-seed meal at $27, $28 or $30, I don't think it ever gets higher. It would only cost you

four cents a pound for protein and that goes a good ways in a year. Now you have got to look at that thing so as to get the food that is healthful and that will keep the animal in good spirits and that costs the least—that having those other two qualities, cost the least.

Take malt sprouts; I suppose $18 would be about right for the malt sprouts, so they would run to about five cents and gluten meal about seven cents. The question is, what will produce the most milk, what is best for the animal and what will cost least having those other two qualities, and fourth, the value of the by-products?

Take cotton-seed meal, for example. It has 24.20 cents worth of fertility to the ton and your cow will throw into the stable 80 per cent. or in the neighborhood of $20 of a by-product, whenever she eats a ton of the cotton-seed meal. Now take all of these features and there you have got it. That is the reason I give this to you; I don't want to occupy your attention but two or three minutes longer. We must give our attention to these things, Heaven knows Pennsylvania needs it, and we have got to get down to this problem or throw up the sponge.

I sold my farm recently and now I am after another. They come to me and want to sell me a farm and I find they have either got to sell it or go to the poorhouse. Now, I would rather pay $200 an acre for good growing soil than take some of them for nothing. I say we need it, and the young stock, the dairy stock, all the stock we can raise to a profit is the solution of the restitution of these acres and in the selection of food; that has got to be kept in view. We must improve the land in this way. There must be the careful selection of foods, as has been indicated and you get your fertilizing material and it comes back on the land in that way you will be rising up higher and higher all the time until you stand triumphant as having dominion over the works of his hands.

Now I shall take the liberty of stopping right here. I just came to give you this single hint. Take this with you, (referring to chart) and study it. That is done very easily, and I beg of you that you go out this winter before these institutes and with all the earnestness and emphasis possible, wake up our grand old Commonwealth on some of these questions that may add so much to its profit.

The CHAIRMAN: We will now have the questions that have been collected.

ROUND TABLE—SECTION A.

(Conducted by Prof. Watson and Dr. Thayer.)

PROF. HANTZ: I would like to ask how far in-breeding can be done so that it may be profitable.

PROF. WATSON: I don't believe it is safe for me to attempt to

tell how far that can be done. We should not want to undertake it very far. Some men have in-bred a good deal and have accomplished quite wonderful results, but in a general way I believe it is safe to let it alone.

PROF. HANTZ: We know there are different opinions; some men claim that it can be done successfully and others do not. I am not experimenting in that line but I would like some information about it.

PROF. WATSON: It is well known that many of our breeds have been established by in-breeding; also that that improvement has been made by master hands, as has been said. I am sorry that I cannot quote the author, but one man in a thousand—this was quoted by some Englishman—but one man in a thousand could make a good member of Parliament. One man in ten thousand would make a good general, and one man in a hundred thousand by putting his hand on an animal could tell what that animal was worth.

DR. THAYER: I have a question here written by some pretty sharp, hard-headed Pennsylvania Yankee:

"Has any set of men tried to intelligently estimate the worth of the humus in the voiding of the horse or cow?"

To that I answer no, because he can't do it. Now then, he can tell the worth from the standpoint of the chemist; he can tell how much nitrogen there is and how much that is worth. He can tell how much phosphoric acid there is, and we know how much that is worth. Potash the same way; he can tell very closely what it is worth in plant food, but I want to express to you my firm conviction that the value in plant food is not more than one-half the real value of that manure as a humus, as an agent to increase the bacterial life of the soil, as a fertilizer. In all these respects, I fully believe it has as much value as the other, but no man can estimate that value accurately. I believe there isn't anything for our farmers like stable manure if it is properly cared for, to start the other things, to fill the soil with life; I have an illustration right in my own experience that shows to me very clearly that is quite true.

QUESTION: "Don't you think it unlocks the soil?"

DR. THAYER: Certainly. If you are going to use lime or commercial fertilizer their effects are very largely increased by having preceded them with stable manure. I have my doubts sometimes if it would not be as cheap to buy commercial fertilizers, if the elements in the manure was all we would have, but really we have more than that, I should judge, twice as much in value.

MR. HALL: It seems to me that we as teachers ought to be able to put some kind of value on this. It would seem that we ought to be able to teach something definite.

DR. THAYER: I have given it from what I have seen right in the soil and I believe that you may double the chemical value of it in the consideration of this larger value.

QUESTION: "Does your definition of a dairy cow apply equally well to the cow kept for cheese production where we wish the cow to milk only seven months in the year?"

PROF. WATSON: Perhaps there are others here who can answer that better than I can.

A Member: That should have been referred to Mr. Lighty instead of to Prof. Watson.

PROF. WATSON: Will Mr. Lighty kindly answer the question?

MR. LIGHTY: I don't suppose it makes very much difference under what line we want to use the product if we want to make money with a dairy cow. She has to produce a certain amount of dairy product above the cost; that is the whole story. If she produces enough in seven months to do this, all right. If I had a cow that would only milk for seven months in the year, and I would have a real mean neighbor that I wanted to treat very badly, I would give him that cow for nothing. I want a cow that keeps at work longer than seven months, and I want her to keep at work in good, solid earnest.

QUESTION: "What is the difference, if any, between in-breeding and line breeding? Is it a safe plan for the ordinary stock breeder to follow either of these systems?"

PROF. WATSON: Line breeding and in-breeding are terms that are used rather loosly and have led to a great deal of confusion; they come together and the line of demarkation is not a distinct one. Some authorities would place it nearer one end, some nearer the other end; some would place it nearer the most rapid in-breeding, and others more remote. Since the authorities do not agree, we cannot say that there is any wonder that this confusion exists in regard to this point. They are both undoubtedly dangerous if carried to extremes; both are safe to a certain extent in the hands of skillful breeders. Neither is safe in the hands of a breeder that goes at his work in a half-hearted way.

MR. BRODHEAD: I would like to ask Prof. Watson a question. Will you please explain—we understand the pure bred in horses is of such a quality as the Percheron, the thoroughbred, the English

running horse; please explain if the standard-bred horse is not a horse of mixed blood.

PROF. WATSON: The standard for horses is a record of performance with their own pedigree. That standard was the English record of running horses and was established with the understanding and firm belief among those English breeders, when the first record was established, that no horse could be a creditable performer on the turf that did not fulfil the required conditions, and that is very true to-day.

MR. BRODHEAD: Isn't it safer for the common, average farmer to improve his stock of horses rather than to use the standard-bred? Wouldn't he better use one of our pure bred horses in the State of Pennsylvania or New York?

PROF. WATSON: Most assuredly, yes. That is a matter of judgment.

MR. BRODHEAD: It would be better to use a pure bred sire than a standard sire.

A. Member: It just depends altogether upon what a man wants to do; whether he wants to raise drivers or trotting-horses.

PROF. WATSON: I take it for granted that a farmer wants to breed horses to use in his business.

QUESTION: "Have you had any trouble with abortion in cows, and if so, how can it be prevented?"

MR. LIGHTY: I don't have any trouble; I know nothing about the means of prevention.

MR. BRODHEAD: We have a doctor from Susquehanna county who I think would be competent to answer that question.

DR. E. E. TOWER: That disease has been quite common in Susquehanna county. I think about three or four years ago we had a case at Glenwood where there were 55 cows in the herd and 53 aborted. The others which calved, died within two hours of their birth. The State Veterinarian came up there and decided to take this up as a test case. I went there over twice a week to treat the animals. We injected a 4 per cent. solution of carbolic acid, about two drachms under the skin, the same as we would inject tuberculin for tuberculosis. At the time we began—this was the year following this terrible epidemic, you might call it, and at that time the man only had thirty-five cows. Twenty out of the fifty-five had been sold for beef, as they failed to do anything further than to make a

fizzle out of the whole thing. We had thirty-five cows in the herd; twenty out of the thirty-five had already aborted. We stopped this entirely and we had fourteen sound, living calves. That was the result of that experiment, and we decided from that, that it was all right.

Now to go on a little further. This last winter I have had already seven and I guess more than that, cases in the vicinity of Hartford and Brooklyn and Bridgewater, and all over the county, for that matter, cases where there would be five to ten in a herd. It became a very serious matter for me to go there to inject this carbolic solution twice a week, so I corresponded with the farmers and I recommended the feeding of this carbolic acid solution. I do not know that it was original with me. I presume not, but I conceived the idea that this might be fed with good results as well as injected, although I can honestly say, I do not think we got quite as good results as from the injection, still in every case, as far as I know, the feeding of this carbolic acid as prescribed, has checked the disease. These cows are nearly all of them either thoroughly recovered or doing all right; in nearly every case the disease was checked right at that point.

A Member: What quantity would you recommend to be fed?

DR. TOWER: I would feed about one drachm at a feed; perhaps what is better yet is to make a 4 per cent. solution of carbolic acid and feed about a tablespoonful at a time, and I would feed this about twice a week at first; some of the farmers overdid that matter.

Adjourned to 7.30 P. M.

PROGRAM—SECTION B.

State College, Pa., Wednesday Afternoon, Oct. 12, 1904.

J. H. Peachy, Belleville, Pa., in the Chair.

The CHAIRMAN: The time is here and past for the opening of our session, and we have first on the program, Professor G. C. Butz, on "Fruit Culture; Orchard Fruit."

Prof. Butz then read the following paper:

FRUIT CULTURE—ORCHARD FRUIT.

By Prof. G. C. Butz, *State College, Pa.*

Pennsylvania is a much better fruit state than is generally supposed or known, and our institute lecturers will do well to equip themselves with fuller information on the subject so that they can speak with greater force and arouse a more active interest in fruit culture. The last census report shows Pennsylvania to be the second state in the Union in the production of apples, and I am proud of the fact; but I am jealous of other states because they are now planting more rapidly than we are and we will speedily loose our high rank. The census report for 1900 estimates the apple crop for 1899 to have been 24,000,000 bushels, and the number of trees 11,775,000, and an average of only 126 bushels of apples per farm. In point of number of bearing trees, our State stands sixth, showing that our yields per tree must have been considerably higher than in other states.

In the production of pears, Pennsylvania ranks fourth, reporting 434,000 bushels. In cherries we rank first, reporting 475,000 bushels. In peaches we rank sixteenth, reporting 143,000 bushels, and in plums we rank thirteenth, reporting about 100,000 bushels.

The fruit plantations in Pennsylvania are considerably scattered over the state instead of being centered in restricted areas. A few centers have been developed in recent years, as with peaches in Franklin and Juniata counties, pears in Montgomery and Chester counties and apples in Adams county; but they have not been maintained with enthusiasm mainly because of the discouragement that follows the advent of troublesome insect enemies and fungous diseases. Fruit growers have not been zealous enough to inform themselves upon the nature of the foes of their crops and the methods of overcoming them, and consequently the serious inroads upon their profits leads to but one conclusion—that it does not pay to grow fruit, and thus it is that run-down orchards and vineyards stand neglected or are reported to grow ordinary farm crops.

A fruit grower should possess intelligence enough to be able to study reports upon the nature of insects and fungous diseases. He should be able to stand in his orchard and looking upon his trees or fruit be able to detect and explain every defect or unhealthy symptom that may be present, just as a doctor diagnoses a case of sickness in a human being. Institute lecturers should prepare them-

selves to explain in simple language the nature of a fungous disease, I take my students into the orchard and have them point out every imperfection in the tree and the blemishes upon the fruit and endeavor to train their eyes in discerning the symptoms peculiar to each disease. I hold in my hand an apple taken from a student's laboratory desk. One side of this apple was punctured several times with a needle; the holes dried up so that it is difficult to see where they are. On the other side of the apple a similar number of punctures was made after the needle touched the spores of the fungus which caused the total decay of a plum. In two days the decay of the apple was showing about these punctures and now after six days you can see that more than half of the apple is brown with decay. Is it not clear then that this side has been inoculated? The invisible spores were carried to the apple and in 24 hours these spores germinated and began to cause the decay of the apple and after six days we find on this apple a new crop of spores. Now the student observes that this rot has particular symptoms which can be distinguished with the naked eye and further corroborated with the microscope. Two rots are shown on this specimen and if you could examine it closely you would recognize differences. There are also unsightly spots of apple scab, and insect injuries. All these things have been made matters of careful investigation by officers of our Experiment Stations and reports are available to every person interested in the subject.

On the matter of feeding orchards, too little is said by the institute lecturers and much less is done by the average fruit grower or farmer. The latter is convinced that to get a good crop of wheat on his farm he must first fertilize his land, but he does not realize that an orchard in bearing removes annually from the soil several times more nitrogen, phosphoric acid and potash than does a crop of wheat. Orchards seldom receive fertilizers except incidentally.

The following figures show the per cent. of several mineral ingredients to be found in the ash of the fruit and wood of the apple and serve as an index of the dependence of the apple upon such plant foods:

	Potash.	Phosphoric acid.	Soda.	Magnesia.	Lime.	Iron.
Fruit,	35.68	13.59	26.09	8.75	4.08	1.40
Tree,	19.24	4.90	.45	7.46	63.60	.07

The great value of potash fertilizers in making fine fruit is emphasized by a close scrutiny of such an analysis. The importance of phosphoric acid cannot be denied, and the assertion that iron in the soil makes the bright colored fruit is also supported by this analysis. It must not be forgotten, however, that light and sunshine are very important factors in producing high color in fruits. The large percentage of lime contained in the tissue of the wood accounts for the fact that orchards in calcareous soils are always healthy in appearance and live longer (other things being equal) than orchards in gravelly and sandy soils. It also supports the recommendation that orchards should be treated to an application of lime (about 50 bushels to the acre) once in four years.

Nitrogen is not accounted for in the analysis as it passes off in the burning of the tissues.

The soda and magnesia are plant foods that are just as important as the nitrogen, phosphoric acid and potash, but all researches on the subject have shown that these elements are supplied in soils in sufficient quantities and in available forms so that we never need to be concerned about them.

The CHAIRMAN: Next we have "The Pruning of Fruit Trees," by Dr. J. H. Funk.

The following paper was then read:

THE PRUNING OF FRUIT TREES.

BY DR. J. H. FUNK, *Boyertown, Pa.*

The subject allotted me is one of the most important of all the subjects with which the Horticulturist has to deal. If in the construction of the large and beautiful edifices that are being built in every large city in our broad and beautiful country, you were to place their construction into unskilled hands, guided by an uneducated brain, although the stone, cement, wood and steel were of the best and a skilled architect were to make the most elaborate plans, writing out the minutest details for his guidance, yet failure would be inevitable; his work would lack strength, beauty, symmetry. So it is with the Horticulturist, he needs the same skill, the same training, with this difference. The Horticulturist must have a better education, a more

cultured intellect and judgment above the ordinary. He has no plans for his guidance. He must be his own architect. You may argue that he has one of the greatest of all architects, one that gives him the most elaborate plans—Nature—the great architect of the universe. To some extent this is true. If you go into the virgin forest you frequently find the most beautiful trees, tall, erect, majestic in their strength, symmetrical in every outline, not a point left to be changed that would add to their attractiveness, but the Horticulturist who would benefit by following the teachings of this great architect must be a deep student of nature studies. She guards her secrets well, and only those who by close observation and deep thought delve beneath the surface are permitted to see and understand her intricate workings. Perhaps in the early days when Adam, the first Horticulturist, was placed in the Garden of Eden, it may not have required any particular skill on the part of Adam to give shape or in any way aid in the growth of the tree or the development of the most luscious fruit. An uneducated mind is satisfied with ordinary results. The child, if nothing better is in sight, is satisfied with little sour fruit growing in the hedgerow.

But we are living in a progressive age. The citizens of every town and city are becoming more cultured. Such products as supplied these cities in the early days of our forefathers, no longer satisfy the citizens of to-day. They have tasted of better things. Their natures crave them and they demand them. We cannot adapt the people to our products. We must produce such goods as the educated tastes of the people demand; and of all the various products there are none that have a more rapid increase in demand than for high grade fancy fruit. This is no longer a luxury, but has become an actual necessity. It is becoming as staple as wheat or any other product. Thirty years back when I planted an apple orchard of 15 acres, my neighbors wanted to know what I was going to do with the fruit, claiming they had to leave their's rot, having no sale for it.

How is the outlook at the present time? Market prices for choice fruit are higher and the demand greater. Never in the history of our country were the prospects brighter than at present, for the future, for the intelligent and industrious horticulturist. In riding over the country it is a sad and painful sight to see the rapid decay of the orchards on large and otherwise thrifty farms which 40 or 50 years ago had large, good bearing orchards, now have but remnants remaining; isolated trees scattered over large areas. These trees and parts of trees, long past their period of usefulness more through neglect and starvation than by old age, are left as feeding grounds for the tent caterpillar which defoliate them year after year leaving their limbs exposed to the hot scorching sun, killing the bark, leaving them a prey to the flat-headed borer which soon destroys the little life that

remains. These trees, once the admiration of the community, the delight of the children, the pride of the farmer, now stand bare and desolate with their epitaph written all over their scarred surface—died of neglect and starvation.

How to remedy this sad state of affairs and avoid its repetition in the future is what I am supposed to tell you. This is a difficult task, as it is a subject upon which opinions differ, nearly every horticulturist and fruit raiser having some pet theory of their own which have proven successful in their case. Why not? There is no one royal road to success; so that Nature's laws are carried out it matters not if methods differ. One man plants and prunes according to his belief in the characters of the constellations believing the sign of the virgin to be one of fruitfulness, in the first quarter with moon pointing down. Another believes the sign of the scale to be the right one, but he wants the last quarter, with moon pointing up. You will find in every community farmers perfectly sane on all else who will not plant their fence-posts when the moon points up or plant their beans when the moon points down. But the days of ignorance and superstition are fast passing away and the bright rays of science are lighting the pathway and guiding the footsteps of the modern horticulturist.

Pruning is the prime factor in the building up of a profitable orchard. The tree is as susceptible of training as a child; in fact, more so as you can train a tree as you wish. You can prune for wood growth, you can prune for the development of fruit spurs. You can make or mar a tree by pruning. The old saying, "there is a time for everything," is especially true with pruning and that time is when the tree requires it. The trouble with pruning is, the work is frequently put off from time to time and then too much is done at once, frequently to the injury of the tree.

There is no branch in orcharding that requires better judgment than that of pruning. It is necessary to understand the nature and the habits of the tree you desire to prune; to understand the individuality of the root system as well as the top. Trees differ greatly both in root and top formation. The peach being a vigorous, rampant grower requiring large amount of available food for its growth and maintenance and maturing of its heavy crops of fruit, has a large number of fibrous roots starting from the body and larger roots than has the apple and pear. He should know where these new roots start first in a newly planted tree, whether from the fibrous roots, from the sides of the larger roots, from the cut ends or as adventitious roots starting from the body below the collar of the tree. When he understands these he is ready for the first step in pruning. What methods shall we adopt? The string-fellow method cutting off all the roots close to the stem or leaving mere stubs, or

shall we cut off all roots to about 3 inches from the stem, or shall we leave all roots 10 to 12 or more inches long.

To decide as to the best method, a series of experiments were conducted at Newark, Del., first on heavy well-drained clay loam, with heavy subsoil 8 to 10 inches beneath the surface. Another trial was made at Seaford, Del., in a well-drained sandy loam with a stiff subsoil two feet beneath the surface, with 54 trees each of 2-year apple, 2-year pear, 1-year peach and 1-year plum. Of these 18 each were stub-pruned, 18 were pruned to 3 inches and 18 were pruned to 8 to 10 inches. Results at Newark of the 8-inch roots, 82½ per cent. lived, 3-inch roots 97 per cent. lived, stub roots 62½ per cent. lived.

At Seaford, Del., 8-inch roots, 94 per cent. lived; 3-inch roots, 100 per cent. lived, and stub 86 per cent. lived.

Of those at Newark, 8-inch roots gave 82 per cent. first-class trees, 3-inch roots gave 92½ per cent. first-class trees, stub roots gave 22 per cent. first class trees.

At Seaford, 8-inch roots gave 86 per cent. first-class, 3-inch roots gave 96 per cent. first class, stub roots gave 51 per cent. first class.

In summing up we find that 3-inch pruned roots gave best results. Eight-inch roots came second, while the stub or string-fellow method gave very poor results.

I am frequently asked by some one who is not particularly in love with work and to whom the string-fellow is very alluring, as by this method all that is necessary is to make a hole in the ground with a crowbar, stick in the close-trimmed tree and close the hole, with no dirt to handle, whether this method is not as good as planting in large holes. This question can best be answered as follows:

In a moist soil, in a moist climate, in a moist year, fair results may be obtained. In stiff soils, in dry soils, in a dry climate, in a dry season results are sure to be a failure.

When shall we begin pruning? The first few years training of a young tree determines largely the form and future usefulness of the tree. When a young tree starts from the seed, bud or scion in a nursery row it sends outside limbs along its stem and these aid in giving the natural taper to the stem from the ground up giving it stiffness. If these are removed too early while the tree is young this symmetry is destroyed, the sap is driven to the top, the top increases faster than the trunk, it becomes spindly, the trunk cannot support the heavy top and the results are deformed trees which, when they come into the hands of the orchardist, need staking to support them. The experienced nurseryman never makes this mistake. Trees coming from a first-class nursery never need staking; it is only those improperly grown. The short time a tree is in the nursery is insufficient to give the tree the proper form. The real training between

the age of 3 and 6 years comes under the hands of the farmer or fruit raiser, and the success of that orchard depends upon the practical knowledge and skill which he possesses. If he has no knowledge of the habits of growth of the different trees and gives them improper pruning in early life all the skill he may attain in future years can never fully overcome the evils of early mistakes.

Very few trees coming from a nursery suit every one planting an orchard. Some want their trees with high tops, others want low-headed trees and both may be right as great success has been attained under both systems. The man who wishes to keep his orchard under cultivation, when in bearing, must have his trees trained higher, while the man who cultivates a few years then adopts the mulch system wants lower headed trees. How shall this difficulty be overcome? By buying one-year old trees. I am frequently asked what aged trees to buy. I invariably recommend one-year old trees. My reasons are first, getting a good, strong one-year old 4 to 6 feet from the bud you get the very cream of the nursery. Anyone familiar with nursery stock knows that only a small percentage gets that size in one year. It must have strong individuality, a strong root system, full of vigor and stored-up vitality. Such stock makes the very best foundation upon which to build. This is not the only advantage with such stock. You have, when cut back, a top and root properly balanced. You can form the head high or low as you desire. Your first step in pruning is the shortening of the roots, cutting off all mutilated roots. Hold the tree with the top farthest from you and the roots facing you. Then with a sharp knife cut off all the roots to 3 to 5 inch stubs with the cut from below outward.

The reason for this is when the tree is set in the hole the plane of the cut surface will be flat on the ground. In a very short time granulations will be thrown out and rootlets will be thrown outward and downward and in a few weeks the young tree will be securely anchored. After the trees are all planted, then prune the tops. The reason for deferring this until the tree is planted, you can start all your tops at a uniform height. If the trees are two years old with tops formed, then cut back from one-half to two-thirds of last season's growth and always, unless the tree is very spreading, cut above an outside bud. If the tree is a one-year old, cut to a uniform height of 2 to 3 feet from the ground. Every one familiar with a young tree knows it is full of dormant buds from the crown to the top; not in straight lines, but ascending spirally around the tree. In a short time after the tree is planted and pruned, if the weather be warm, these buds swell and send forth young, tender shoots making the stem quite green. Now is the time to form the top. Seize the top of tree with one hand count five buds from above down, then grasp the tree at this point with the other hand and with a down-

ward sweep you rub off all the buds below. This leaves five buds to form the new top. These limbs receiving all the nourishment they can use make rapid growth and must be carefully watched as they may become top-heavy; if such is the case pinch off above the outside bud. This checks the rapid upward growth and makes the limb more sturdy. By this method you will have no forks. The terminal bud grows as a leader and the four lower buds form four limbs all growing out in regular order and no one quite opposite another, with an outward, upward tendency to each limb, having at its base a ring or collar formed which strengthens it to such extent that, though in future, when ladened with fruit, it may bend to the ground; it cannot split from the trunk. Very little more pruning is necessary during the first season. Early in spring of second season, cut back fully one-half or better, two-thirds of last season's growth, except leader, which should not be cut back quite so hard unless you desire a very low spreading top. This pruning again gives the limbs an outward upward curve thus spreading and forming an open head, giving that beautiful symmetrical form combining beauty and strength. If through any mishap, carelessness or otherwise, one of these limbs should be broken, leaving one side with a large gap, this may be remedied by, instead of cutting above an outside bud, you cut above a side bud facing the gap. Then as the new growth curves toward each other the gap is soon closed. You may perhaps have a few crooked trees (some varieties are naturally crooked growers) this can be easily remedied with that wonderful implement, the horticulturist's standby, the pruning knife. I do not mean a large cumbersome hooked knife. I never owned one. I mean an ordinary strong, sharp, pocket knife; with such I can cut off a limb one inch or more in diameter with one smooth, clean cut. It is all in knowing how. Grasp the limb with one hand spring it upward and follow with the knife giving it a good strong pressure and you will be surprised how easily it is done. Now as to your crooked tree. With the knife, make two or three perpendicular incisions in the concave portion of the tree the full length of the crook. Nature in her efforts to heal the wound throws out granulations; this part grows faster, fills up the hollow space, acting as a brace, and in two or three years the tree will be straight.

Fourth year. Perhaps by this time your trees may be too spreading. If so, prune to an outside bud, thus throwing your new growth upward and inward. It is presumed that you have cut out all unnecessary growth, and where two limbs cross one must be removed. But good judgment must be used to remove the right one, or later you must remove the other one and this may leave a large, open space making an unsightly gap and exposing the large limbs to sunscald. If at anytime you must remove a large limb, better paint

the cut surface. Trees, hard-pruned, throw out many water sprouts. These should be removed as they are useless and rob the tree of so much nourishment and make too much shade; but spare the fruit spurs. Many farmers and even professional pruners, tree butchers I call them, do not know the difference between useless wood and fruit spurs.

In 1880 I planted 15 acres of orchard. Tended it well. It became a model for beauty, and came into early bearing as any well-regulated orchard will. One day a gentlemen called to see my orchard. After going through it he remarked: "You have a fine orchard, but you have made one serious mistake. You have too much wood in your trees." I asked him too show me where. He pointed to the fruit spurs of which I was so justly proud and said they were robbers and should come out. I told him I wanted them there. He left, assuring me I would find my mistake to my sorrow. He said he was a fruit raiser and knew what he was talking about.

A few years later when this orchard was heavily ladened with choice fruit well distributed through the entire tree, this same gentleman again called. After again going over the orchard he said he had an apology to make. I asked him what. He said when he was here before he had said there was too much wood in my trees. Now he saw I was right and he was wrong. My trees were bearing heavily and scarce bending the limbs, while he had cut out all the fruit spurs and driven all the fruit to the ends of the limbs, bending them down, exposing the bare limbs to the heat of the sun, killing the bark which was taken possession by the flat-headed borers and his orchard was ruined. In many sections there are people who make a specialty of grafting and pruning, traveling from farm to farm. Some of them may be all right but most of them should be avoided as a mad dog. They tell you your orchard needs pruning, which is doubtless true, as I never saw one that did not. They tell you there is too much wood. You think, as it is their business, they know it all and as you are busy you turn them in. Later you come along to note progress and what a sight meets you. Your once beautiful trees now remind you of a post planted with a few poles stuck on the upper end with a brush tied on the upper end of each. This professional tree butcher has trimmed off every fruit spur that was along the main limbs leaving them bare, not only destroying all hopes of early and heavy bearing but inevitably destroying the health and longevity of the trees, as no tree can thrive with trunk and large limbs exposed to the hot sun. Farmer friends, if one of these men should call upon you, question him closely and if you find him an imposter turn the dogs on him. Many wish to know the best time to prune. That depends upon the object. In young trees where wood growth and tree formation are the principal objects, early spring or late fall is the best

time. But if your orchards have an abundance of wood, having the age with no inclination to bear fruit then you must adopt some other method. You must check the superfluous growth and direct its energies in other channels. There are various ways to attain this; perhaps you have been giving too much nitrogenous food and too high culture. Try seeding to grass for a season or two giving it more potash and phosphoric acid, and prune your trees in June. You will find that instead of wasting its energies in making terminal wood it will develop fruit spurs throughout the tree which the following season will bear an abundant crop. If a tree, after all judicious means has been tried, still fails to bear, try the heroic remedy, ringing the tree. Take a sharp knife, make an incision entirely around the trunk or limbs, make another one an $\frac{1}{8}$ or $\frac{1}{4}$ inch from, but parallel with the first and remove the strip of bark. This must be done in June when the sap flows freely, being careful not to destroy the cambium. Or you may wrap a wire tight around the limbs. Either of these methods check the return flow of sap and develops fruit buds. If you doubt, try it. It will respond without fail and if properly done will do no injury to the tree. But as my article is getting lengthy, I will close with a few safe rules.

Before planting, prune. After planting, prune. If growth is too strong, prune to check it. If the growth is too weak, prune to make more vigorous. Prune for wood, prune for fruit. Avoid all forks. Remove all cross limbs. Cut out all dead wood. On cutting off limbs, leave no stubs but cut close to the trunk or larger limbs. Keep the trunk and larger limbs shaded. Encourage growth of fruit spurs along all limbs that the fruit will be well distributed and not all on outside limbs. By using good judgment, pruning and fertilizing liberally but judiciously the farmer will find the family orchard will be the most profitable part of his farm, besides the great pleasure it affords himself and family.

ROUND TABLE—SECTION B.

(Conducted by Prof. Butz and Dr. Funk).

QUESTION: Would you recommend stable manure for the peach orchard?"

Answer: I am speaking only of the apple. You can determine that problem best by making an experiment. It is between you and your own soil. The expert prefers rather the poorer soil on which to grow peaches.

MR. SCHWARZ: A great many people have an idea that if a tree is planted toward the south, they will get different results.

Answer: Nothing in it. I don't care what way your orchard stands, whether it is pear, peach, plum or apple, if your trees are

properly nurtured, if you get your trees trained right and nurtured right, you will be successful.

MR. STOUT: In trimming trees, how can it be determined how the top will form afterwards?

Answer: It is presumed that a man in planting an orchard knows the variety he is going to plant. If he has studied carefully, he knows some are not straight in habit. Did you ever know of any business man engaging in any enterprise that would last a lifetime who would go recklessly and blindly into that enterprise? If he wil attend the farmers' institutes, he will understand how to train these trees.

MR. STOUT: We had no farmers' institutes when we started these orchards.

MR. CURE: Do you recommend starting these trees only about $2\frac{1}{2}$ feet from the ground?

Answer: I do.

MR. HOOVER: In regard to scoring, would you score the whole trunk of a tree which is "hide-bound" or "bark-bound."

Answer: No. Give it sufficient nourishment to soften that bark. If it is properly fed and the trunk kept in good condition by spraying and washing, it will not be "hide-bound."

MR. RODGERS: I understand Dr. Funk to say that 3-inch pruning proved to be the best. Why was it that it proved to be better than either of the other two prunings?

Answer: I don't know that I can give you any scientific reason. I gave you an account of experiments that had been conducted in Delaware. In every instance the 3-inch pruning has given the best success. Perhaps Professor Butz can give you the reason.

PROF. BUTZ: I do not know that there is any scientific reason. It is our practice to prune long roots short and to prune the top at the time of transplanting. Our directions are to prune the top to correspond with the reduction of the root. There is a longer course for the food to travel before it reaches the growing portion of the stem. Grapes make long roots; we cut them short. In celery, cabbage and strawberries, we shorten the roots because the development of rootlets is nearer to the plant itself. Just why there is such a difference between 3-inch and 5-inch pruning, I do not quite see. Of course it takes a great number of instances to prove or to settle a principle. If one experiment which had a number of trees in it, is

sufficient to prove that three inches is better than 5, we should follow that rule.

MR. RODGERS: I find that what suits one tree will not suit another in variety. I have cut off all dead wood, all bruised wood, all roots that looked unpromising and occasionally have had to cut less than three inches.

MR. BEAVER: The true principle is in the compacting of the soil. If you have a tree that has roots five to eight inches, it will not be so sure to stand and grow as in cases where you have long roots. I find that where there are few long roots, if the ground is effectually compacted, one will be successful.

QUESTION: What time of year is best to prune?"

Answer: That depends upon your tree and its age. Young trees should be pruned in early spring or late fall. Prune whenever your trees needs it. That is the only safe rule to follow.

MR. RODGERS: In regard to "ringing" trees, will not cutting the bark off clear around the tree, prevent the sap from going down? What time of year do you advise "ringing" a tree, and will it injure the Northern Spy?"

Answer: Pear, peach, plum, Northern Spy are not hurt. You can bring any tree to early fruiting by that method. If you take a peach limb and run a copper wire around it, you will retard the flow of sap, and you will double or treble the size of the fruit. If I were going to "ring" a tree (and I recommend this only as a heroic remedy) I should do it early in June. I have done this in dozens of cases early in June and the next year the tree would be loaded with fruit.

MR. McHENRY: A fruit tree that has been neglected in the pruning, is there any difference in the time of year that you would prune that tree with a view to starting water sprouts?

Answer: Early and late pruning will throw out more water sprouts than summer pruning. As they start out, prune them out. The circulation there is limited. Prune back and feed at the same time and try to get new life into that tree.

MR. HOOVER: I should like to consider one point with Dr. Funk. A common mistake is to plant a tree with as little trouble as possible. As a rule, tree planters do not dig their holes large enough nor give enough of loose surface under the tree. I think a tree planter should make holes very large. He should take a sharp iron and loosen the soil as deeply as possible.

QUESTION: "Is the application of iron an advantage to a bearing orchard?"

Answer: Yes.

QUESTION: "Will not crimson clover take the place of barnyard manure?"

Answer: Yes, indeed.

QUESTION: Can it be determined from the annual growth when fertilizing is advisable?

Answer: Yes, by observing if it is reasonably strong and of a healthy color.

On motion, adjourned.

Bellefonte, Pa., Wednesday 7.30 P. M., October 12, 1904.

W. H. H. Riddle, Butler, Pa., Chairman.

The session was called to order at the designated hour by the Chairman.

The CHAIRMAN: We are now ready to begin the exercises of the evening, and I see by the program that we are to be treated with music, a duet by Mrs. H. A. Surface and Mrs. J. P. Pillsbury.

Mrs. Surface responded to an encore, and the music was very much appreciated.

The CHAIRMAN: I understand we have with us to-night the Editor of the *American Agriculturist*, a very pre-eminent and useful agricultural paper, who will discuss "The Art of Instruction as a Science." This is a subject in which we are all very deeply interested at this time, and I am glad that we have with us a gentleman so well qualified to speak on this topic. I now have the pleasure of introducing to you Prof. W. G. Johnson.

THE ART OF INSTRUCTION.

By Prof. W. G. Johnson, *Managing Editor American Agriculturist, New York City.*

Mr. Chairman, Ladies and Gentlemen: I hardly know whether it would be proper for me to take up the subject that has really been assigned to me to-night. Talking with Brother Martin coming down on the train, I thought it would be highly proper for me to lay aside the subject of "Instruction as a Science" and take up the subject some other way. I am still of that opinion. I told him I had never delivered an address by reading it. But this subject is so very important in its general character and there are so many

things to be considered that I have thought it wise to jot down a few points that I can give to you and bring out in this general line of work, and possibly weave around them and intertwine with them some thought that may possibly be useful to you in the magnificent work that you are doing, and will be called upon to do in the future.

There are some things about this subject with which you are very familiar, especially with the practical nature of it. I can safely say, without being disputed, that Pennsylvania has produced more farmers' institute workers of a practical character than any other state in the Union. Now I do not except the great State of New York or that other state nearly as great, Ohio. But I must say that Pennsylvania has gotten out in the highways and byways and brought forth some of the best public speakers in the institute work of the United States to-day.

Now, I say this in all fairness to other states. We realize that in New York and that is why we want some Pennsylvanians with us in our work. Ohio is reaching over the line and getting them there. Maryland, West Virginia and other states in the vicinity are doing the same thing. There is some reason for this. It simply means that at the head of this great department you have a man who is unequaled in his understanding of agricultural conditions; and in referring to my good friend, Mr. Martin, I know that one of his strongest points is the fact that he can put his finger on a man in any section of the State who has done something to uplift and help agriculture. When we get back of the whole thing we find there is always somebody who is leading; somebody who is able to differentiate from this great mass of the people who were good farmers, and bring out those particular individuals who have made a success of some one particular thing. If there ever was a time when it was necessary for a man, and particularly for a farmer, to concentrate his thought on some thing, it is now. He must be a specialist along some certain lines, which will bring him the dollars and cents. That is what you are working for, and what you are looking for. Nothing has afforded me more pleasure in my life's experience, and given me more inspiration, than the history I wrote a couple years ago of one of your farmers whose methods have been heralded throughout Pennsylvania and the borders of the United States; not only that, but throughout the entire world. It is sufficient for me to say that I have had pass over my desk, printed in seven different languages, the accounts of that famous fifteen-acre dairy farm of the Rev. Dr. Detrich.

Now there is a principle back of all this. In the first place, the man at the head; in the next place, the scientific and fundamental principles that underlie all forms of agriculture. Whether you differentiate those into horticulture, animal husbandry, or grain and general agricultural crops, the fundamental principles remain the same,

and we must get back of all this. When a few years ago I visited this famous little farm down at Flourtown in the suburbs of Philadelphia, I found there a man, modest in general make-up, a man who had been making a little fifteen-acre plot of land which years ago would not have been considered sufficient for the support of two cows and a horse—I found that man there on that fifteen acres, producing the sum and substance of the livelihood of thirty head of dairy cattle, including two horses. When I found this, I made up my mind that the agricultural possibilities of this country were still locked up and in the region of the unknown in many of the so-called farms in this country. Here then is a scientific truth which I want to leave with you. We must first thoroughly understand the conditions with which we are working. It makes no difference whether you are growing cow-horn turnips or something else—I see some of you smile, I can't help smiling myself when I speak of those crops and Seeds the expert. Any farm is capable of producing an enormous crop of roots on a given area if well handled. When properly utilized, that crop has a certain value from an economic as well as a scientific point of view. One man in this State, whose name is known throughout the institute world as "Bob" Seeds, has worked out a problem with cow-horn turnips on a so-called abandoned farm which to-day has given him the results about which he speaks; and results are what we are all looking for. It is the results that we are after, and without results of satisfactory character, our bank account at the end of the year, usually turns in the wrong direction.

Some of you have produced fruit of an exceptionally fine character, and when I want sufficient evidence of that, all I have to do is to turn to this table here at my right, to see it demonstrated. I have on my desk at the present time an item coming from a Pennsylvania farmer asking, why it is that Pennsylvania does not produce more apples of a commercial character, suitable for the export trade and desirable for our home markets. It is not meant to say that she does not produce some fruit such as it is on the farms throughout the State. In passing over the territory through which I traveled yesterday afternoon coming over here, I saw pile after pile of apples on the various farms, and their appearance was certainly fine; at the same time there is a possibility on these soils and on these hills for a far better production along this particular branch of horticulture, and whenever you find horticulture and these ideas well advanced, you find men who are studying the problems in such a way that they get down to the bottom facts, and when they get to the bottom of those facts, they are getting results, and when they get the results, they get their returns in the form of money. And I really believe, as I stand here, that one of the greatest possibilities

that you have in Pennsylvania to-day, is along horticultural lines. We have not begun to awaken to the possibilities of development along this particular line. The same may be said of vegetables. Take the great trucking sections in the vicinity of Philadelphia and elsewhere, Pittsburg and Scranton, wherever you find these small tracts of land devoted to truck farming, and what do you find? You find men not farming 160 acres of land, you can find men who are not working over sixty acres of land, but they are concentrating their efforts on a small area, and from these areas they are making their livelihood and most of them are prosperous, well-to-do citizens. They are making a living, putting by a little surplus at the end of the year, educating their children, keeping them in the public schools, sending them over to State College, or possibly they are in the University or some other institution. We find that sentiment growing throughout the country.

A few weeks ago it was my pleasure to visit a little farm on Long Island, farmed by a German, in the general line of truck produce. It was a small tract of land which ordinarily would hardly yield a sufficient income to provide his own living and pay the taxes, but on that ten acres in nine years he tells me, he has taken on an average of a hundred dollars an acre of clear profit, in addition to all the expenses and outlay for handling the garden produce which he produces, and disposes of in Brooklyn and New York. In addition to that he has two sons that he is now keeping in the State Agricultural College, all from the results of that little ten-acre farm. I am simply giving you these facts to show you that there are such farms in existence. We have got to come to a point when we must concentrate along certain lines.

One other illustration of this sort and then I am through with this line of talk. It was my pleasure to visit a little five-acre farm in Florida, on my visit to that state in March. From these five acres were taken off last year a crop worth from $800 to $1,200 an acre. Now that seems almost preposterous on the face of it, yet it is true. One of his crops is lettuce, and that lettuce is now being planted and will be shipped into the New York and Philadelphia markets within sixty days. Following that comes his celery, and following the celery come egg plants.

Now these are some of the phases of this subject which I have endeavored to present in the few minutes which I have had at my disposal. I have jotted down certain things of a general character for your consideration, and will devote the rest of my time to their consideration.

Nature and experience are the best teachers. Not one of you will dispute this. For years I have been conscious of the fact that the best training comes from an immediate acquaintenance with the

myriad forms of life. Books are not the original sources of education or information. Some of us, at least, consider them artificial; yes, even second-hand. Books are mere aids and should thus be considered by the real teacher. Do not understand that I underestimate the value of books. Far from it. In them experience must be preserved; history recorded; great problems in social, economic and political life must be preserved. Yet in the face of all this, do we not tell our children too much; do they not rely more upon a faint and scanty knowledge of recorded facts and the experiences of others rather than incidents in their own lives? This principle is not confined to the children alone; but many of us older ones are apt to think that grandfather's methods, usually preserved in an unwritten book, are good enough for us. The records of practical, everyday experiences are far more important. The man who observes that he can produce five bushels more wheat on an acre, by using a new variety equally as good, would be unwise, indeed, to stick to the old seed, used for generations on the same farm. We should be on the lookout for something better. Nothing is so good that improvement of some sort is not possible.

Methods of farm management are constantly changing, consequently the work of the instructor, teacher and institute speaker varies accordingly. A successful teacher may be one who has mastered his subject by familiarizing himself with the work of somebody else and is capable of imparting this knowledge to others; better still, he may be the possessor of his facts by actual experience and capable to tell in a plain, simple style how he produced his results. Fortunately, this latter class of teachers (they might be called farm missionaries) are increasing rapidly. The effects of this sort of practical instruction are far reaching and it seems that we are approaching nearer the goal of "true art in instruction" than ever before. We find it gradually creeping into our city schools. It has already changed systems and methods of teaching; it has opened up new avenues in the rural districts; it is making the older occupants of our farms "scratch their heads and think." Never was there an age when practical knowledge was more eagerly sought; hence the necessity of skilled artists in instruction. Was there ever a time when the call for volunteers was made public, that the response was more promptly answered by "Here am I." It came from the farms of the State. No better confirmation of this fact is needed than the volunteers in the Farmers' Institute Department in Pennsylvania and other states.

Each one of you had a duty to perform to yourselves and your family. You have succeeded by "doing things" where others have failed. Some of you have taken abandoned farms, scarred with the experience of poor management and made them, not only profitable,

but object lessons, representing the best methods of advanced farming. Many of us think our farms are "run out." We can't make both ends meet. The common cry with such people is "farming don't pay," and it is literally true. Let the same individual engage in any other business and the story would not change. Year by year, through the College of Agriculture, the Experiment Station, the State Department of Agriculture and the system of the Farmers' Institutes as now conducted, we are improving conditions. Results on every hand show clearly the wisdom of instruction along these lines.

Is there anything that gives greater dignity to man than a complete realization of the power of being able to do, and do it well. "No joy is greater or more lasting than that received by doing well with the complete being,—brain, eye, hands, will and judgment—all tools, God-given tools, to be trained and used." In times, not long past, the best energy of our country was devoted to trade activities, to material welfare; but in the process of evolution, of the differentiation of institutions, other ideas in education must prevail. Many people are beginning to realize that one object of education should be to qualify the individual to enjoy life fully in whatever environment he may be cast, while at the same time develop a capacity to achieve material success. Such capacity depends, in part, upon discovering at an early age one's best bent or peculiar fitness for some special vocation, and then training for this purpose not only the mind, but also the hand and the eye, indeed, the whole organism and forming the practical judgment as well as the power to reason theoretically.

We are daily impressed with the multitude whose life's work is more or less unsuccessful. No place, I am sorry to say, is this more apparent than in some rural districts. The inability, however, of book-learning alone to train the judgment to deal with practical affairs is everywhere recognized. Its failure to develop originality is admitted. How true this is about farm life. Mere book studies are also deficient in training, earnestness of purpose and tenacity of application. Nowhere is this more conspicuous than when applied to farm management.

That "life is a search after power," is as true to-day as when Emerson wrote it. Personal power is to a man what steam is to an engine. If a man's knowledge is extensive and accurate then his influence, that is, his power over others, outside of example, is the power to convince or persuade, a power largely dependent upon an ability to think clearly, combined with a readiness of speech and accuracy and attractiveness of expression in presenting the truth. A knowledge of technical facts, combined with skill of the hand and eye does not necessarily give the power which is essential to large success. There is no power in a fact or in a technical process. The power lies in the man and its exercise comes in the use of what he knows.

Two men may have equal knowledge of the composition of soils, fertilizers and crops, but be very unequal in their success in applying this knowledge; this inequality being due, outside of differences in natural ability, to unlike mental power, that is to unlike ability to reason and co-ordinate facts in their bearing upon a particular problem. Such reasoning powers come from mental discipline and while certain technical studies have high disciplinary value, attention to these alone does not produce a well-rounded and symmetrical mental development—the result is a one-sided development and the subject of it has serious limitations of mental vision.

The institute worker and teacher meets these peculiarities in individuals in every class-room or audience. How to balance an address or temper a subject to meet the greatest number of persons in any gathering is not an easy task. I have frequently known persons to appear on a platform and discuss a subject entirely different from the one announced on the program. This was not done, however, without reason. Last winter I was scheduled for an evening address on "Co-operative Work Among Farmers," at an institute in a thrifty dairy section. A blinding snowstorm raged all day long and late into the night. It was impossible for farmers to get to the hall. The meeting was called, however, but the audience consisted of about 25 persons from the village. The subject discussed was not "Co-operation," as announced, but "Little Things in Nature That Help Us." As a result, the address was repeated in the same hall the following spring to a crowded house. Many teachers fail in the class-room and elsewhere because they lack a complete mastery of their subject. A student young or old, is usually quick to discover the weakness of a poorly prepared instructor. A good instructor should be full of his subject.

The CHAIRMAN: The next thing in order is music. We shall now have the pleasure of listening to another piece of music by Mrs. H. A. Surface, with piano accompaniment.

The CHAIRMAN: To know what influence the local institute worker exercises is certainly a very important question and we have with us to-night two editors of "The National Stockman," a paper that has done so much for the cause of institutes in Pennsylvania, that I know you will be pleased to hear one of its editors discuss this very important question, and I now have the pleasure of introducing to you, the genial Mr. T. D. Harman, Editor of *The National Stockman and Farmer*, who will address you on "The Influence of a Local Institute Worker."

MR. HARMAN: Mr. Chairman, Ladies and Gentlemen: My speech is entirely extemporaneous and, therefore, as I have been taken

wholly by surprise and have only had since last June to prepare it, I will have to read it:

THE INFLUENCE OF A LOCAL INSTITUTE WORKER.

By Mr. T. D Harman, *Editor, National Stockman and Farmer, Pittsburg, Pa.*

The history of the world has not recorded the annals of a more worthy cause than that of man in his efforts to subdue the earth and make the desert blossom like the rose. An all-wise Creator decreed that "man should eat bread by the sweat of his face." Unwise creatures have in their hearts condemned this decree and have, from all time, endeavored to reduce the degree of this sentence to the minimum or have it stricken entirely from the statutes. The former endeavor, in the light of modern ideas, is commendable, but the latter will never be accomplished, as it is a decree of God which cannot be changed.

Agriculture always has been and always will be the foundation of the prosperity and happiness of the inhabitants of this earth. Time does not even permit us to refer to the crude methods and the hard problems of sustaining the lives of the populace during the early years of the world's history. Men living to-day remember the wooden mould-board plow, the flail and the spinning-wheel. Scarcely a generation ago the crude implements and methods of the Syrians and Egyptians were common in the rural districts of our own beloved Commonwealth, and I doubt not to-night that in some of the remote nooks and corners of our State the soil is tilled, the harvests gathered and the grain threshed and winnowed in almost the same manner that this work was performed in the days of Pharaoh.

We are living in a wonderful age. The rapid strides of improvement and development are seen on every side and in every direction. Improvement is the watchword of the hour. In every line of work the command to go forward is heard. The snail's pace has given way to the speed of the railway train and the swift trolley line. Only a few years ago we were content to count a day's journey but a few miles. Now we think nothing of crossing a continent in a few days or skipping over the face of our greatest oceans within a week or two. We cannot stand still. A few moments resting on our oars

permits the vast concourse to pass us by. The man who does things to-day the same as he did yesterday is not only standing still but is falling behind, which is discouraging.

But, I hear some one ask, is agricultural pursuits and methods going along at as rapid a gait as other lines of work? It certainly is. The last fifty years has wrought more changes for the better in agriculture than all the years before them. The brightest minds of inventive genius have contributed their full share in this direction. In fact, it is generally admitted that the limit in improved farm implements and machinery has about been reached. It would be hard to get better facilities to prepare the soil, plant the seed, till the crops and gather the harvest than we have to-day. With all this at hand the burden of further improvement rests with the farmer himself. Just as infinite wisdom has been shown in looking up the resources of this earth and making it obligatory upon man to unlock it and use it as it is needed, so has it been wise to make the mind capable of development. The material world does not change. The flowers which bloomed on this continent when the Pilgrim Fathers landed at Plymouth Rock now bloom around us in their season. The stars shine with no more lustre now than when they sang together in the glory of their birth. All nature is the same. For her no new forces are generated; no new capacities are discovered. The earth turns on its axis, and perfects its revolutions, and renews its seasons without increase or advancements. But a like passive destiny does not attach to the mind of the inhabitants of the earth. For it the expectation of improvement is no delusion. The hope of improvement is not a dream.

These thoughts lead up to the topic which has been assigned for discussion at this time. The improvement in the material things connected with agricultural pursuits should not exceed the improvement in the mental capacity of those who are most directly interested. There was a time when it did. Leaders in thought recognized this fact. The case was diagnosed and a remedy sought. The result was the organization of farmers institutes as we have them to-day. And they are equal to all occasions if properly conducted. The command, "Go ye into all the earth and preach the gospel," was no more divine than is the call of the man to go forth and preach the gospel of better farming as at the present time. So far reaching in its good results and so popular has the work become that within the past year many men have claimed the honor of originating this method of education. States and localities vie with each other in doing the greatest good in the work and appropriations are made in the most liberal manner by our commonwealths and general governments. The brightest men of the country are employed in directing and carrying out to full completion these institutes. Time and money are not

spared to make them successful. Trials and inconveniences are endured by those who labor along these lines that border on the heroic, for he is a true hero only who will sacrifice his own comfort for the betterment of his fellow-man.

Notwithstanding all the good things that may be said about this great and good work, there has been, is, and always will be some weak spots to be found and opportunity for improvement. The director of institutes has no sinecure. His business is to get together the best material he can and make the best of it after he has secured it. From my own personal knowledge he is besieged for work by men who should be in the pew rather than the pulpit. Men who have the "gift of gab" imagine they are called to the work if the per diem and expenses will bring them in a greater income than a run-down farm conducted in the most disreputable way. Such men generally want to be assigned to districts remote from their homes where their audiences cannot know that they do not practice what they preach. Then there are those who have a political pull or a relative pull or a pull of some kind that make claims for recognition in this, we might justly say, sacred work. God grant that the day is not far distant when politics and work of this kind shall forever be divorced. Men of the first-class or the second-class or of any class that are not fitted for the work should be selected to stay at home until they have learned to do things as well and tell how to do them, for the fountain never rises higher than its source.

To get down to the subject more closely requires that personalties be indulged in. To be a good institute worker requires enthusiasm. The speaker should be full of it. It should not, however, be all one-sided. Happy is the man who is able to get his audience enthusiastic as well as himself. If it be lacking anywhere let it be in the speaker and not in the hearers. Eloquence is a very desirable attribute of the speaker at an institute. Daniel Webster, America's most eloquent orator, said that eloquence must exist in the man, in the subject and in the occasion. You are the man, your subject is of your own choosing, and the occasion is always at hand if an audience of farmers have left their fields and flocks or their cheerful firesides to listen to advice as to how to improve their conditions. Eloquence is a combination of high purpose, a firm resolve and dauntless courage, reaching the heart of the hearer. Two things are absolutely essential to eloquence. First, the speaker must know what he is talking about, and second he must mean what he says. That is the whole thing in a nut-shell. There are many men who seek glory by their eloquence, who court popularity by carrying their audiences with them by oratorical effect, by grand-stand plays. Such men lose sight of the truth often and mislead their hearers by substituting

high-sounding sentences and phrases for common-place truths that might sink into the hearts of their audiences and bring forth fruit.

The long-winded speaker is probably one of the greatest detriments to good work at our institutes and, as a consequence, has a bad influence. The president of a theological institute in addressing a graduating class of young ministers, told them that thirty minutes was plenty long enough for a good sermon and entirely too long for a poor one. This can be aptly applied to an institute talk. A man who has a message to deliver and cannot get to the point inside of a reasonable time should go into training under some one who can reduce his record. There may be times and places for long drawn-out speeches, but it is not at farmers' institutes. They will have a bad effect upon the work.

The man with a repertory of subjects, as long as the wine list of a French cafe, is another man to be avoided. Life is too short for any one to be authority on all subjects. It is evidence in itself of egotism, or of ignorance. A man who can talk on every subject seldom talks well on one. The old saying: "Beware of the man with but one book," applies here.

A bore at the institute is the man who is prosy and does not put enough life into his talk to keep his hearers interested or awake. Henry Ward Beecher once told his sexton that whenever he found a man in his audience asleep he should come around and waken him (Beecher) up. An audience will never go to sleep or lose interest as long as the speaker keeps awake and is full of interest. Whenever he fails to interest he should stop.

Using a common, but very expressive phrase, the institute worker who is continually "butting in" has a very bad influence on an audience. It is commendable to be ready to help out when occasion requires, to stir up things when interest is lagging, and possibly correct some one when he is in error, but the greatest care should be used in how and when it is done. An institute can be killed quicker by wrangling over unimportant matters than in any other way, and the professional "butter in" is the one who generally starts discussions over trivial things, or, as a rule, he is unable to discuss topics of much depth.

We should take off our hats to the scientific man, self-made man, for what he has done for agriculture and agricultural pursuits; yet there are men of the deepest knowledge who are worse than useless before an audience of farmers. Such men are often mere theorists. Their work should be to translate from the terms of the scientists the grains of golden knowledge in such simple language that the man whose opportunities to drink at the fountain of knowledge has been neglected can understand and believe. When scientific men work along these lines their usefulness is beyond question and their

influence of the best. When they do not, they lose the confidence of their hearers and are not appreciated as they should be.

One great mistake made by some workers, is in trying to revolutionize conditions and practices found in various sections. They have worked out some plan or scheme which has proved a success on their own farms. They become enthusiastic over it and attempt to cram it down the throats of the farmers in other parts of the country where conditions are entirely different. Men who have taken up the problems of farming where their fathers left them and have given their best thought to making the best of the situation, generally know what is feasible and practical as far as their own conditions are concerned. There are always ways of reaching such men and helping them, but it cannot be done by impressing them with the idea that you know it all and that they have been making mistakes all their lives. The best judgment of any local community, as evidenced in its practice, is not to be considered unwise.

Suggestions along these lines might be carried on indefinitely. Your influence for good will be the more enduring by avoiding the errors in others. It will be the more powerful by aiding your fellow-worker to avoid them himself. It is a fact that all reforms in societies, in methods, in conditions are effected through the masses of the common people. The tendency of the people is to advance and golden opportunities are before you to aid them.

Your work is the most noble that falls to the lot of man. Your privileges are great. Your responsibilities are paramount with your privileges. You are leaders of men and moulders of destinies. It is, therefore, important that your influence be for good.

The CHAIRMAN: There being no other business for this evening, the meeting stands adjourned until to-morrow morning. The train will leave for State College at 8.15 ,sharp, and it is hoped that you will all be on hand promptly.

State College, Pa., Thursday, 9.30 A. M., October 13, 1904.

The session was called to order at the designated hour by S. X. McClellan, Chairman.

MR. MARTIN: On this, the third day of our Institute, we deem the time has come when a few announcements ought to be made. There are some resolutions which this convention necessarily ought to adopt before its adjournment. To that end we appoint Mr. W. F. Hill, of Franklin county; Mr. M. N. Clark, of Westmoreland county and Mr. George G. Hutchison, of Huntingdon county, as a Committee on Resolutions. Of course these resolutions pertain to the work of this organization. You will notice that Mr. S. X. McClellan will be our chairman for this morning's program, and the Rev. J. D.

Detrich is placed first on the program. We have had word that Mr. Detrich expects to be here, but has not yet arrived, therefore, we deem it best to proceed with the program, and Prof. T. I. Mairs, who is placed on the program from 10.30 to 11.30, will kindly take the place of the Rev. J. D. Detrich, hoping that he may arrive in time to give his lecture a little later, probably this forenoon.

I have word from Dr. Pearson that he expects to arrive this morning and fill his place upon the program. The two classes, Sections A and B will meet in the same rooms as yesterday afternoon. In Section B, Prof. R. L. Watts will have charge, the subject being "Market Gardening," and Prof. H. A. Surface also in Section B, on the subject of "Insect Preventives." Their addresses will be given in room 121. Prof. Butz will lead the way to that room. All interested in market gardening and insect preventives will repair to that room at once.

PROGRAM. SECTION A.

The CHAIRMAN: As has been explained by Mr. Martin, owing to the absence of Rev. Detrich, we will begin with Prof. Mairs. His subject is "The Care of Milk and Butter."

I now have the pleasure of introducing to you Prof. T. I. Mairs.

PROF. MAIRS: Mr. Chairman: It would probably be presumptous for me to attempt to tell any of you how to care for milk and butter, at least for me to attempt to tell some of you how to care for milk and butter, as some of you have doubtless had more experience in that line than I have had. I have quite considerable written out here which I hope not to read to you, because when I read an article I feel more like a schoolboy reading an essay than anything else and of course I imagine I look that way too, and I do not feel like I am giving any instruction or that any one is getting proper benefit out of it.

There are a great many things which are to be considered in the care of milk and butter, and I am able to touch upon only a very few of these, and rather lightly upon those.

Prof. Mairs then read the following paper:

THE CARE OF MILK AND BUTTER.

By Prof. T. I. Mairs, *State College, Pa.*

VALUE OF MILK AS A FOOD.

From the nature of milk, its use as a food is repulsive to many people unless great care is used in handling it. Pure, fresh, sweet

milk is one of the most perfect foods, and its production and consumption are steadily increasing. Its increased use is due chiefly to four qualities: 1. Palatability; 2. Nutritive value; 3. Digestibility; 4. Cheapness. All these are influenced more or less by its care.

The palatability of milk is due to its components being mixed in such proportions as to produce a flavor that is relished by most people. Milk, to possess good flavor, should be secreted by healthy cows carefully fed with this in view. It should be as free as possible from animal taste or odor, and should not be permitted to take up any foreign ordors, whether by absorption or by mechanical contamination. Fresh milk when drawn under ordinary conditions contains gases and animal odors, which may be eliminated at once by cooling and aerating it in a pure, clean atmosphere. If allowed to stand, there oftentimes develop in it disagreeable flavors.

Such defects may occur at anytime, but if the milk is handled intelligently they will not be serious. They are not, as was formerly thought, due to the chemical condition of the food, the illness of the animal, etc., but for the most part are associated with the growth of bacteria, molds, etc. Milk being intended by nature for the nourishment of the young and containing all the elements of nutrition, affords a fertile field for the growth of nearly all kinds of low organisms.

Milk should be cooled to 50 degrees F., which temperature will check fermentation and preserve its good flavor for about 48 hours, provided, the utensils and surroundings are perfectly clean. If not so treated, milk will go off in flavor, and even at this low temperature will lose its palatability. The most common change is the transformation of milk sugar into lactic acid, causing the milk to become sour. Souring of milk is really beneficial as it serves to give a warning. Slimy and bitter milk are very common; both may originate in the activity of bacteria. Bitter milk may also be caused by certain feeds, such as lupines, and is sometimes characteristic of milk obtained from cows which are nearly dry.

Milk comes the nearest to being a perfect food because it contains the elements necessary to maintain the body. Bread made from wheat flour will support life. It contains all the necessary ingredients required for nourishment, but not in proportions best adapted for ordinary use. One might live on beef alone, but it would be a very one-sided or unbalanced ration. Milk is in itself a balanced ration.

All of the food constituents in milk, except fats, are present either in a state of solution or semi-solution, thus rendering them easily digestible. In most other forms of food they exist in a solid or semi-solid form. For children whose masticatory and digestive organs are not efficient as those of the adult, fresh milk is an ideal food. The fats in milk being present in the form of minute globules which

are held in suspension, are in condition to be taken up and assimilated in the human body. Any treatment of milk changes the arrangement of the milk solids and renders them less digestible.

The cheapest food is that which furnishes the largest amount of digestible nutriment at the least cost. One quart of milk (2 lbs.), three-fourths of a pound of moderately fat beef, such as sirloin, and 5 oz. of wheat flour, all contain about the same fuel value and the same nutritive material, but different prices are paid for them, and they have different nutritive values. It may be assumed that the cost of one pound of round steak is about 12 cents, one pound of sirloin steak, 15 cents, and one pound of milk, $2\frac{1}{2}$ cents. In price, five pounds of milk are equal to one pound of round steak, and six pounds of milk are equal to one pound of sirloin steak:

Five lbs. of milk worth $12\frac{1}{2}$ cents has a total fuel value of—1625 Calories.

One lb. round steak worth 12 cents has a total fuel value of—855 Calories.

One lb. sirloin steak worth 15 cents has a total fuel value of—970 Calories.

It will be seen from this that the fuel value of milk is much greater than that of beef, when the price of each is taken into consideration. Beef is one of the most common and most nutritious foods consumed; hence, it is safe without considering a large number of foods, to say that milk could be used to advantage more generally than it is at the present time. Adding the healthfulness and palatability of the milk to its cheapness makes it a very desirable food. It is owing to this fact that the demand for pure milk is constantly increasing.

MILK FOR CITY SUPPLY.

With the increased production of milk for direct consumption in cities, greater care must be exercised in order to get it into the market in good condition. According to United States statistics, nearly one-third of the milch cows in the United States are necessary to supply the people with milk for use in its natural state, i. e., for drinking purposes. In some of the larger cities, especially the eastern cities, the average daily per capita consumption of milk is reported by the United States Government to be one pint or more. The smallest average daily consumption in large cities is about one-fourth of a pint per capita. This is in New Orleans where the milk supply is notably inadequate and unsatisfactory.

KEEPING MILK IN GOOD CONDITION.

Owing to the necessity of bringing milk to cities such long distances, the problem of delivering it to the consumers in a good con-

dition is a vital question. Milk should always be hauled in covered wagons, in order that it may be better protected from the sun and dust. Jackets for the cans made of felt, or some other non-conducting material, are recommended. Milk cans with umbrella tops are to be preferred to those with funnel top, since there is less surface on which the dust may collect. The cans of milk should not be left in the sun, on the railroad platform.

Precautions must always be taken to prevent the development of the germs always present in the milk. Although these germs may be destroyed by heat, or removed by mechanical means, these processes can never take the place of careful handling and of sanitary barn condition. The old adage, "An ounce of prevention is worth a pound of cure," cannot be too often impressed upon those who handle milk. Greater care is required in the handling of milk for city trade than in handling it either for butter or cheesemaking. It must not be thought from this that good cheese or even good butter can be made as easily from impure as from clean milk.

Milk should never be handled any more than is absolutely necessary, as handling, however careful, always increases the liability of contamination. For this reason it is well to get the milk bottled as soon as possible. The best classes of milk are always bottled on the farm. The practice of bottling milk on the farm and shipping the bottled product to the city is to be recommended wherever it is possible to follow it. This, however, will increase the expense and the cost of milk to the consumer, as the transportation charges on the bottled milk and the empty bottles are much greater than that on milk in cans. The bottled milk requires more care in handling and the loss of broken bottles is greater than it is when the milk is bottled by the dealer.

STABLING.

With the care of the milk is intimately associated the care of the cows. Ideal conditions should be maintained as far as possible.

Barnyard: Some form of yard for exercising the cows daily is desirable. The care of the stable begins with the care of this yard. It should approach as nearly as possible to a clean, open field or pasture; it need not necessarily be large, but it should be well-drained and must be kept clean. It is a mistake to exercise the cows in the manure yard. It increases the work required for keeping them clean and the cows will have a tendency to eat the bedding which has been hauled out with the manure.

If the cows have a dry, light, comfortable place for exercising, they are better off outside for several hours during the day. If on the other hand, it is necessary for them to wade through mud to their knees during the fall and spring, and shiver around in the

bleak winds and snows of winter, and lie in the hot sun and dust of summer, the less time spent in the yard the better. In this climate the weather does not get too cold to turn the cows out for exercise, provided, they are protected from the winds and damp. The more time spent by the cows in the open yard, the less labor will be required for keeping the stables clean, and the easier ventilation will be accomplished.

The exercise yard should be protected, both, from the heat of the summer and from the storms of winter. A yard sloping towards the south with an open shed along the north side is very satisfactory. This yard may be paved with cobble stones, it may be macadamized or it may have a good coat of cinders. At any rate the cows should not be permitted to trample it out or get it muddy. If the cows are left outside for some hours they may be fed part of their roughage in this yard. A manger may be placed along the back side of the shed for stormy weather, and racks in the open barnyard for fair weather. The cows may obtain their water either in the barn or in this yard, preferably, in the yard as it will be found more difficult to keep the stable clean when watering devices are placed in the stall. They also increase the expense of the equipment.

One advantage in having feed racks outside is, that whole fodder may be fed more conveniently. If corn stover is fed in the barn it is necessary to have it shredded, it may be fed outside, however, without this expense. Before the advent of dehorning, the turning of the cows together in the yard was sometimes more harmful than beneficial. At present, however, that all cows are dehorned there is practically no danger.

Barn: In the production of sanitary milk a good barn is considered an essential. It should be constructed so as to furnish thorough ventilation, abundant light, and should have mangers and floors that can be easily cleaned. Provision should be made for a living room or stable, a milking room and a milk room. This should contain the bottling, weighing and separating machine with a refrigerator adjoining.

Living Room: This should be the main room of the stable in which the cows are fed and kept, except during the grazing and milking periods of the day. In constructing this room, provision should be made for proper lighting and ventilation. To secure the former, windows may be placed along the sides of the barn. These windows should fit tight to exclude the cold air during winter. They should also be furnished with blinds to darken the stables during the fly season. It should have no loft overhead, especially if the cows are milked in this room. It should at least have a tight floor above. Bank barns are more apt to be too warm than too cold. The micro-

organisms are much more active in a warm room than in a cool one. A temperature of 40-50 F. is warm enough for well-fed cows. If it occasionally drops below the freezing point at night, no harm is done. The heat radiated by the animals will keep any ordinary room warm enough at night when the doors and windows are closed.

Plenty of light in a stable is desirable for at least four reasons:

1. It encourages cleanliness.
2. It facilitates doing the work.
3. It is necessary for the health of the animals.
4. Direct sunlight is one of the best germicides.

Where stables are dark, the attendant is frequently ignorant of a great deal of dirt and filth that may exist in them. Where dirt is not seen it is often not disturbed. If the stables are light enough, so that the dirt will show plainly, they will in all probability be kept much cleaner. Dark basement stables always encourage slighting the work. There are in this State a great many cow-stables which have no light except from one side. This light comes from the overshute and very little is admitted even from there. Occasionally windows are placed on the ends of bank barns, but these are often filled with straw or manure during the winter.

The ventilation of stables is necessary: 1. To furnish oxygen. 2. To remove exhalations, carbon di-oxide, moisture, ammonia, marsh gas and organic matter. 3. To remove micro-organisms, dirt, odors, etc. All of these are necessary to the production of pure milk. The ideal ventilation would remove these products as fast as formed. Ventilation may be secured by means of shafts located in the walls. Each shaft can be arranged to ventilate two or more rooms; the impure air in passing out, enters the shaft through an opening near the floor, while the fresh air can be admitted to the stable room from an opening near the ceiling. The source of the fresh air should be the best obtainable. It should always be secured from an elevated point instead of near the ground.

Floors: The floors, except of the stalls, may be made of cement. If the stalls have cement floors, the cattle are frequently troubled with rheumatism. For "stall-flooring," gravel or wood is preferable; but the latter, however, is difficult to keep free from odors. Some modern stables are provided with cement floors with plank covering so arranged that it may be readily removed and cleaned. A dirt or cinder floor if well-drained and kept in good condition is often found satisfactory. If odors arise, gypsum may be sprinkled over the floor occasionally with good effect. For bedding, sawdust may be used, if easily obtainable; if not, straw will be a good substitute. Any feeding material is objectionable for bedding purposes on ac-

count of its high bacterial content, which may, later, contaminate the milk.

Stalls: The "Bidwell" stall, slightly modified, is probably one of the best for this purpose. This stall can be adjusted to fit any cow and yet have a continuous manger by making the platforms of different widths, e. g., make it four feet, seven inches wide at one end of the stable and five feet wide at the other. Then a wide cement manger is constructed in which is placed a hanging lattice work, which can be moved forward or backward. By a little adjusting, the stalls can be made to fit almost any cow, and are at the same time easy to keep clean. Stanchions are not objectionable, provided they be comfortable and some arrangement is used to keep the cows from stepping on each other.

Cleaning the Stables: The stables must be cleaned daily, twice being preferred to once. In addition to removing all waste material, the floor, stalls and mangers should be flooded with water and scrubbed, and disinfectants used, whenever needed. Probably the best disinfectant, is a solution of corrosive sublimate (one ounce of the sublimate in eight gallons of water). This will have to be applied with a broom. Spraying pumps cannot be used because of the corrosive effect of the sublimate upon the metal. Some of the coal-tar products, as creolin and zenolenm, are useful as disinfectants. After thoroughly covering all parts of the stable with the disinfectant, the whole should be washed again, so as to rinse away the disinfectant, especially if corrosive sublimate is used, which is an intense poison. A white-washing of the walls is very desirable. It makes more light in the room and at the same time acts as a disinfectant and deodorizer.

While discussing disinfection of stables, it might be well to consider how the same treatment could be applied to the cow. All the long hairs around the cow's flanks, udder and tip of the tail should be clipped. Then she should be washed thoroughly with boracic acid. The teats should also be carefully washed. A disinfection of the animal, as described, is usually sufficient to remove the micro-organisms, which are a source of trouble.

Feeding: In a model dairy barn, the cows should be fed after the milking period. Only good, pure food should be used. Distillery feeds, spoiled silage, etc., are objectionable. During the fly season the animals may be fed in the darkened stable during the day and turned out at night.

Milking Room: This room is not absolutely necessary, especially if the stable is kept clean, but is very desirable, if the highest class milk is to be produced. It need not be large, but should be arranged so that it can be easily kept clean and easily ventilated.

Plain stalls should be provided for the cattle to stand in while being milked. Stall floors should be so constructed that they may be kept clean. The walls should be disinfected and whitewashed as often as required to insure cleanliness.

In the production of sanitary milk great care must be exercised when the milk is drawn, otherwise it may be infected with bacteria. If a separate milking room is used the cows which have been previously curried are taken to this room as needed. Here a man is kept who proceeds each milker and wipes off the cow's udder, flanks and teats with a damp cloth or sponge, the cow having been previously groomed in the stable. This treatment reduces the bacterial contamination greatly. After the cows have been groomed, they should be kept from lying down by fastening a chain or rope under the throat. The milkers, who are clothed in white suits, use pails with covered tops. These pails have openings for the admission of the milk. Over these openings may be placed strainers of various kinds. If cotton is used, the cotton must be destroyed after each milking and fresh material used for the next. The milk when drawn is taken to the milk room where it is cooled and bottled, either with or without previous treatment. Such milk should not contain more than 1,000 to 10,000 bacteria per c. c.

Milk Room: Conveniently near the milking room and stable should be the milk room or rooms. These may contain the scales, separator and bottling machine. The floor should be of cement and the walls tiled to a height of six feet, and where possible, they should also contain a sterilizer and a sink, the latter for washing the milk utensils and bottles. There should be no direct communication between the stable and the milk room.

A first class arrangement would consist of three rooms—a weigh room, a bottling room and a wash room. After weighing, the milk is poured into a receiver, from which it runs through the partition into the bottling room. In the bottling room it may be aerated, clarified, standarized or pasteurized and bottled. Beyond the bottling room is the wash room. Persons passing from the weigh room to the wash room, or vice versa, should not pass through the bottling room. The sterilizer should be situated in the partition between the wash room and the bottling room, and should have two doors, one opening into each room. With this arrangement the bottles may be placed in the sterilizer from the wash room and taken out in the bottling room. If three rooms are out of the question, one or two may be used. The milk should at least be removed from the stable as soon as drawn.

It seems hardly necessary to mention the thorough cleaning and sterilization of the milk bottles, pails, cans, strainers, etc. The sterilization can best be done by exposing the vessels to live steam.

When a closed sterilizer is not at hand a stem jet may be used. If neither is convenient, the vessels should be scalded with boiling water or, preferably, boiled in a larger vessel. Pails of pressed tin are preferable to those of pieced. The tin plate should be heavy and of the best quality that it may not dent easily. They should always be washed with lukewarm water, that the casein and albumen may not be cooked on the metal. All seams should be flushed with solder before the utensil is used, in order to make it more easily cleaned.

CERTIFIED MILK.

Milk produced in the manner described, and with which is furnished some warranty of cleanliness or wholesomeness is known as certified milk. Certified milk may be of two kinds. In one case, the certificate guarantees only that the number of bacteria contained in the milk shall be below a certain limit when marketed. In the other case, the source of the milk is investigated, that is, the cows are examined by the proper veterinary authorities, and when the examination warrants it they give to the dairyman a certificate stating that the animals are free from contagious diseases. The stable is also inspected, and the methods of handling the milk before it is marketed are investigated. Such milk can be produced at a cost that is slightly in advance of the cost of ordinary milk. It is, therefore, reasonably cheap, costing not more than one or two cents per quart above the ordinary price. This milk is to be preferred to uncertified milk, because it is likely to be more wholesome. Greater care is required in handling and marketing it in order to maintain the small bacterial content.

SANITARY OR HYGIENIC MILK.

The better grades of certified milk are known as sanitary or hygienic milk. In producing sanitary milk, all possible precautions are taken to exclude both mechanical and bacterial filth. The cows are tested for tuberculosis and examined for other diseases at least once a year, and the stables constructed after the most approved plans. No new cow should be admitted to the herd without being first inspected by a competent veterinarian and tested for tuberculosis. The production of sanitary milk involves greater expense and greater care. To be produced profitably, the dairyman should endeavor to secure the co-operation of some city board of health. He should then satisfy the members of this board that the milk is sanitary, and in return have them recommend it to invalids and families with small children. In many of our cities the board of health and societies of a philanthropic nature are endeavoring to provide such milk. They not only investigate the conditions under which it is

produced, but the bacterial content of the milk as well. Good milk should not contain a large number of organisms—2,000 per c. c. (cubic centimeter) being the limit.

Of course it is understood that not every dairy farmer is or can be so situated that he may produce milk in the above described manner. The production of such milk is expensive and the producer should be paid in proportion to the greater expense and care involved. Milk when treated in this way sells for twice as much as ordinary milk. The demand, therefore, is somewhat limited, and a special trade must be built up for it.

CLARIFYING AND FILTERING.

After milk is drawn it is sometimes subjected to treatment to increase its keeping qualities. Foreign particles may be removed from milk by straining, filtering or clarifying. Bacteria may be destroyed by heating, as in sterilizing and pasteurizing or by chemical treatment, or they may be kept from developing by refrigeration. Chemical treatment is neither legal nor legitimate, and should never be resorted to. Aeration does not add to the keeping quality of milk, but only serves to permit the escape of gases and disagreeable odors.

Sometimes milk is passed through a separator before it is cooled. This is called clarification. Many of the impurities are removed with the separator slime. After separating, the milk and the cream are remixed and cooled to 50 degrees. When milk is treated in this way and kept cold, it will remain sweet for several days. Separators intended for use as clarifiers sometimes have an arrangement for re-mixing the skim milk and cream. The arrangement of the fat globules is not the same in clarified milk as in the original. While most of the dirt and one-third to one-half of the bacteria are thrown out in the separator slime, the keeping quality of the milk is not much increased.

Filters for the purification of milk, by passing it through sand, gravel or felt, under pressure, have been placed upon the market from time to time, but have not come into general use, owing to the difficulty of keeping them clean. They remove only the larger mechanical particles. Bacteria cannot be strained or filtered out as they are much smaller than the fat globules.

STERILIZATION.

In order to thoroughly sterilize milk by heating, the temperature must be raised to 212 degrees F. on several consecutive days. Such treatment gives to the milk a cooked taste and renders it less digestible. For these reasons it cannot be used in treating milk for drinking purposes, and is useless in treating milk for buttermaking, as will be shown later.

PASTEURIZATION OF CITY MILK.

Pasteurization may be defined as a process of applying heat to

milk for the purpose of destroying the vegetable or growing forms of bacteria. It is really partial sterilization and may be accomplished in two ways:

1. By heating the milk to a comparatively high temperature for a few seconds only.
2. By heating the milk to a lower temperature for some minutes.

The first is known as the continuous, the second as the intermittent process. The time required will bear some relation to the degree of temperature used.

It is not advisable to use the first method for treating market milk. The normal milk fermentation may be conveniently divided into three classes; namely:

1. The lactic acid.
2. The butyric acid.
3. The peptogenic or putrefactive.

The peptogenic and butyric organisms are spore-bearing, that is, when introduced into an unfavorable environment, as may result from the application of high or very low temperature, they are capable of producing very resistant, hard, glistening bodies which develop into bacteria when again introduced into a favorable environment. Because of these spores, these two classes of bacteria are very hard to destroy. A temperature of 185 degrees for a few moments, or 155 degrees F. for 15 or 20 minutes will destroy most of the vegetative forms, but will not destroy the spores. These spores will become bacteria if the temperature of the media in which they are found is reduced to 70 to 90 degrees F. They correspond somewhat to the seeds of the higher plants in their action. The latic acid bacteria are destroyed very easily—a temperature of 140 degrees F. applied for a few minutes accomplishing this result. In addition to these organisms producing normal fermentations, there are sometimes found in milk what are called "pathogenic," or disease-producing organisms, such as the germs of typhoid fever, tuberculosis, diphtheria, etc. These pathogenic bacteria are rendered non-injurious by continuous pasteurization at 185 degrees F., or by an intermittent exposure for 15 to 20 minutes at 155 degrees F.

From the above facts concerning bacteria and their relation to temperature, it is apparent that an application of heat to the extent of 185 degrees F. for a few minutes, will destroy or render non-injurious most of the bacteria found in milk; but on the other hand such a high temperature will give the milk a decided cooked taste, which renders it unpalatable to most consumers. To avoid this cooked flavor, milk should not be heated above 158 degrees F. This temperature will not destroy bacteria, with the exception of the lac-

tic acid group, unless they are exposed to it for 15 minutes. Such an exposure in the continuous pasteurizer is impossible, for the milk must be drawn off as soon as it reaches the desired temperature.

Continuous pasteurization at 185 degrees F. will prevent the milk from souring, because it destroys the lactic acid bacteria. The lactic bacteria may spoil the milk for market purposes by rendering it sour, yet they are, on the whole, not injurious. The injurious organisms may remain undestroyed by such a partial pasteurization. Hence, the intermittent pasteurizer must be relied upon for the successful pasteurization. The continuous process is used chiefly for pasteurizing milk and cream for buttermaking, and for pasteurizing skim milk at creameries.

The continuous process destroys the lactic acid group and the pathogenic germs, but does not destroy the spore-bearing kind. For this reason it is necessary to add a starter to pasteurized milk or cream in order to obtain the normal sour cream for buttermaking. If the starter were not added, the cream would putrefy or decay before it would sour. By first destroying all the chance lactic acid producing bacteria and then reinoculating it with a pure culture, of what might be called, pure bred or pedigreed bacteria, the buttermaker is more able to control the flavors of his product.

In pasteurizing milk by the intermittent process, either of two methods may be employed, as follows:

1. Pasteurization in bulk in an enclosed tank.
2. Pasteurization in bottles.

Pasteurization in Bulk: When large amounts of milk are to be treated, the first mentioned method is to be preferred.

There are on the market several forms of pasteurizers or one may be made to order.

If neither of these is convenient, milk may be pasteurized in cans, in double vats or in any vessels which may be heated gradually and uniformily without danger of scorching the milk. When heated in vessels of large size, it is necessary that the milk be constantly stirred, in order to insure a uniform temperature and to prevent the albumen from adhering to the sides of the vessel. The source of heat should be hot water rather than steam, as there is much less liability of the milk becoming overheated or being cooked on the sides of the vessel.

If desirable, milk may be bottled and then pasteurized afterward. This method of pasteurization is the better of the two when not more than 200 to 250 quarts are to be pasteurized, since the milk is not exposed to the air after pasteurization and the liability of re-contamination is avoided.

There are also on the market domestic pasteurizers intended for pasteurizing milk for infants. These usually consist of a set of bottles suspended in a vessel of water. An ordinary range or a small oil stove may be used for heating the water. A thermometer in one of the milk bottles indicates when the desired temperature has been reached.

While pasteurizing milk destroys the disease germs, authorities are not agreed upon the value of pasteurized milk for infants and invalids. Undoubtedly the albumen undergoes a change even at a temperature as low as 150 degrees F. This change renders it less digestible. It is a question whether the danger from the organism in ordinary milk is greater than that from the indigestibility of the pasteurized product. Undoubtedly, if milk is known to have been produced and handled under sanitary conditions, the raw product is to be preferred. It is almost impossible to pasteurize milk without imparting to it a certain flavor which is more or less noticeable. While this flavor is not relished by most people at first, others never detect it at all; some persons even acquire a taste for it, so that they prefer pasteurized to raw milk.

Pasteurization of milk for city supply is on an increase, especially in the West where the methods of handling and caring for milk are more crude than those of the large, up-to-date Eastern model farms. Pasteurized milk under similar conditions contains fewer germs than unpasteurized milk, even if the raw milk is handled under the most sanitary conditions. Pasteurization, however, should never be allowed to take the place of sanitary handling. The numbers of germs in milk is not an absolute index of its safeness. A very small number of pathogenic germs would be more harmful than a million lactic acid producing germs. Lactic acid seems to retard the development of putrefactive germs, and its presence in the intestines is often beneficial rather than injurious.

STANDARDIZATION OF MILK.

A partial modification of milk is made by some who own up-to-date dairy farms, where hygienic milk is produced. This modification extends only to the changing of the fat content; for instance, orders may be filled calling for milk with 2 per cent. fat, 4 per cent. fat, 6 per cent. fat, or milk containing any amount of fat. If the percentage of fat content exceeds a certain standard (about 5 per cent.), then the price for one cent a quart for each per cent. of fat it contains; for instance, if cream tested 35 per cent. fat, then it would sell for 35 cents per quart, and if it contained 50 per cent. fat, then it would sell for 50 cents per quart.

This modification of the fat content of milk is accomplished by

skimming the whole milk. The cream obtained is tested for fat by the Babcock test; calculations are then made to find out how much skim milk and how much cream containing a definite amount of fat it will take when mixed together to produce milk containing a definite percentage of fat; or it may be done by adding cream to the whole milk without skimming it, provided the required percentage of fat is not below the test of the whole milk. This latter method is not advisable for the following reasons:

1st. The cream and milk will not mix as if both were of the same age and of the same kind.

2d. Such cream also is likely to inoculate the milk with bad germs, and cause it to sour or otherwise develop undesirable flavors.

3d. This method would also be more laborious, as it would necessitate testing the milk as well as the cream for fat, and a more complex method of calculation is necessary.

4th. This method could not be made use of at all if the required standard percentage of fat was below the test of the whole milk.

The amount of care which may be given the milk will depend of course upon its ultimate use. The farmer who is selling milk to the creamery or cheese factory at 2 cents a quart would hardly be warranted in bestowing that amount of care on the milk which would be required of the man who is selling a sanitary milk at 8 cents a quart. Although creamery and cheese factory patrons may not be warranted in devoting that attention to the keeping quality of their milk which the condenseries or milk dealers must use, there is no excuse for the careless and filthy manner in which milk is often handled. There is no excuse for the cows not being reasonably clean and the stable well-bedded and lighted. The saving in feed and in the health and comfort of the animal more than balances the extra labor required. Much that has been written and said on this subject has been impracticable, and for that reason the farmer has been suspicious of it all. Too much has been written from the standpoint of the physician and not enough from the standpoint of the dairyman. The physician of course knows that the milk is impaired, but is unable to locate the cause. Some boards of health have gone so far as to condemn all milk from ensilage-fed cows. This of course is an exaggeration, as ensilage may be fed without in the least injuring the quality of the milk. Ensilage must not be fed, it is true, immediately before milking. If fed immediately after, the taste is very difficult to detect. This will apply to a great many other feeds.

Whatever its ultimate use, the milk should be handled as little as possible after it is drawn, and the place where it is stored should be little disturbed. A separate room for storing the milk and butter is quite desirable, but cannot always be had. This room must be kept scrupulously clean, as any milk which is infected will at once

set up fermentation and cause trouble. The walls and floors of all rooms where milk is handled should be of such material that they may be easily cleaned, and that they will not absorb moisture or other substances. The old practice of storing milk in spring-houses was quite commendable, as the milk was in that manner kept cool and the running water served to keep the air pure and to carry off any undesirable odors. Unfortunately, not all farms are situated so that they may have the luxury of such a building.

After the spring-house, the next best way to keep milk is by the use of ice. This, of course, is more expensive than keeping it in running water. If the profits will not warrant the use of ice for preserving, and the spring is not available, the next best thing is a cave or cool cellar. This must have thorough ventilation, but must be so situated that currents of hot air from the outside cannot pass through it. It is very difficult, therefore, to construct a satisfactory cave or cellar. In order that ventilation may be perfect in warm weather, the air of the chamber must be changed often. This necessitates the introduction of warm air from the outside. Thus the temperature of the milk is raised and its keeping quality is impaired.

Owing to the difficulty of keeping milk for any great length of time without considerable expense, it is desirable to put it into the hands of the dealer or buttermaker as soon as possible after it is drawn. Whenever it is possible to deliver milk twice a day, this plan is more desirable. In the majority of instances people have found it more convenient to deliver the milk once a day, in the morning. The oldest then is about 18 hours old. If the milk is to be delivered only once per day, the evening and morning milk should never be mixed. It seems that in mixing old milk with that freshly drawn, both have the tendency to sour quicker than if they had been kept separate. In all cases the morning's milk would sour much more rapidly if mixed with the night's milk, than if left alone.

The CHAIRMAN: The next thing on our program for this forenoon will be the paper of Prof. Wells W. Cooke, entitled "The Effects of Feeds on the Quantity and Quality of Milk."

Prof. Cooke read his paper which is as follows:

THE EFFECTS OF FEEDS ON THE QUALITY AND QUANTITY OF MILK.

By Prof. Wells W. Cooke, *Washington, D. C.*

All acknowledge that there is some relation between the feed and the milk. If onions are fed to a cow it is expected that the milk

will have the odor and flavor of onions. The same is true of turnips, but in a less degree. If, however, the turnips or cabbage are fed in moderate quantities directly after milking no bad result is noticed, because in this case the system has had time enough to eliminate the malodorous material.

There is another feed—silage—that is fully as strong in odor as onions, and to some persons, even more unpleasant, and yet a cow can consume large quantities of even the rankest silage and produce milk without a trace of the silage odor.

This is denied by many dairymen, but nevertheless it is a fact, when a man says that he is having trouble with his milk on account of the feeding of silage, he is charging himself with carelessness, for it is certain that the bad flavors entered the milk after it was drawn from the cow. The silage odor is very penetrating. It hangs to the hair of the cow and the garments of the milkers; it fills the air of the stable. When silage is fed just before milking and then the milking done without washing the hands, the milk is almost sure to be tainted. Milk left in the stable easily absorbs the silage odor.

These odors that enter milk after it is drawn from the cow, can be largely removed by aeration. Merely lifting the milk in a dipper and allowing it to fall in a current of pure air will remove the bad odors, but on a large scale it is better to use some of the modern machines that aerate and cool at the same time. To test this matter with regard to silage, I once divided a lot of fresh milk, putting part in the silo on top of the silage in an open pail, while the rest was submerged at once in ice water. The milk remained in the silo several hours until it was thoroughly saturated with the silage odor. The pail was then removed to the dairy room and fresh air blown through the milk until the air as it bubbled up smelled no longer of silage. This milk also was then put in the ice water. The next day samples of each lot were submitted to a large dairy class without their knowing which was which. The majority of the class decided that the silage milk was the better flavor and had the less odor.

Why should good milk result from bad smelling silage and poor milk from onions? If a very thin slice of onion, turnip or cabbage is examined under a high power magnifying glass, the tissue will be seen filled with minute drops of a sulphur oil that imparts the peculiar odor and flavor. The system of the cow tries to burn up and get rid of all that would injure the milk, but these sulphur oils are among the most difficult to eliminate from the system and unless fed in quite small quantities, produce a bad effect on the milk. On the other hand the odor and taste of silage are connected with the acids of fermentation, and are easily destroyed by the cow. When silage first came into use, some persons claimed that the large quantity of acid it contained must be injurious to the health of the cow. A per-

son who says this, displays his ignorance of the cow's process of digestion. The first great stomach or paunch—occupying nearly half the cow's body—is in effect, a silo. The food is here carried through the first stage of digestion, entirely by the production of acid. No matter whether the food is green or dry, grain or coarse fodder, it is all fermented and produces large quantities of acid. Dry corn fodder in the cow's paunch evolves much more acid than the same stalks would have produced put green into the poorest silo. The cow's system burns up and utilizes this acid with ease, for that is what nature intended.

The feed has an effect on the color of the milk and the resulting cream or butter. Green grass, clover and carrots are well known to give a yellow color to milk and butter. Of the grains, corn and oats probably tend to produce a milk most satisfactory for general household use. On the other hand buckwheat middlings has the most injurious effect. When the first two are fed with good clover hay, the cream is well-colored and has a good consistency. It comes off the top of the pan in a thick layer and leaves skim milk that is noticeably different in color from the cream. If now the change is made to buckwheat middlings and timothy hay, the cream will become thinner and whiter. It will not cohere so that it can be removed as a layer, but will need to be dipped out a small amount at a time and one can scarcely tell the cream from the skim milk. Such milk is unsatisfactory to the housewife and it will be impossible to make her believe—what is, however, the fact—that the latter milk contains just as much cream and will make as much butter as the first.

The feed effects the hardness of the butter, that is, its ability to stand up in hot weather, and also its grain. Corn and oats make a good grained butter, wheat bran and linseed meal, a poor grained, while if buckwheat middlings are fed in large quantities a butter is produced that looks and cuts like lard. Gluten meal rich in fat, makes a soft butter, while cotton-seed meal has the most pronounced effect of all the feeds in making the butter hard. Indeed in the South where cotton-seed is fed largely, the butter-fat is so hard that the churning temperature has to be raised at least five degrees.

The phase of the question most interesting to the dairyman is, what should be fed to increase the amount of fat in the milk. So far no satisfactory affirmative answer has been given. The present belief of those who have studied the problem most thoroughly is that feed does not affect the richness of the milk, that is, the pounds of butter-fat in each hundred pounds of milk. The present doctrine is that each cow has her own normal richness of milk due to her individuality and her ancestry. This richness varies in different cows; in some it is three pounds of fat per hundred pounds of milk, others

four pounds, some five pounds and a few still higher. Any good, healthy food given in proper quantity will bring the cow up to this normal quality of milk and after that no change of food can change quality, either to make it richer or poorer. During a long series of years I tried a great variety of feeding stuffs on cows to see if I could find one that would induce the cow to produce richer milk. Only once did I succeed. When "cream gluten meal" first came on the market, it was claimed by the makers to increase the per cent. of fat in the milk. I bought half a carload for experimental purposes, fed it to a herd of cows and noted the results with great care. The milk began at once to increase in quantity and improve in quality. When the experiment had lasted a week, I calculated that if it would do every time what it had done so far we could afford to pay eighty dollars a ton for it. Then one morning one of the best cows was found dead, and examination showed the others to be in a state of high fever. The dead cow's liver was found to be enormously enlarged. This explained the trouble. The liver is the part of the body that deals with fat in the food. The cream gluten meal was very rich in fat and the four pounds per day per head contained more fat than the liver could handle. An extra amount of fat had been thrown into the milk in the endeavor of the system to rid itself of the surplus. But it was at the expense of health and the other cows would have soon succumbed had the feeding continued.

As already stated, this is the only time I have been able to trace any relation between the feed and the richness of the milk, though I have tried most of the feeds on the market in a great variety of combinations.

There are several changes in feed that are popularly supposed to influence the richness of the milk. Many believe that if a cow is fed heavily with salt so that she drinks an abnormally large amount of water, the result will be an increased flow of a poorer quality of milk. There is no such effect produced. Most dairymen believe that when the cows are fed any wet food in large quantity, as for example, silage, roots or wet brewers' grains a similar result will follow. Their belief is incorrect and arose probably in large measure from the influence of such foods on the color and the consistency of the cream as already mentioned. The belief is prevalent that when cows are turned to pasture in the spring, the change from dry feed to wet induces a larger flow of poorer milk. Indeed this idea is so grounded in dairy thought, that it is incorporated in the laws of some states that allow a poorer quality of milk to be sold during May and June than during the rest of the year. I have tested this matter both with my own herd and with some three hundred cows belonging to several different farms and representing widely varying environment, feed and care. In some cases the milk improved slightly

when the cows went to pasture, in some it changed in the opposite direction. The average was practically no change.

Yet every dairyman knows that milk varies in its richness. If, then, this is not due to the feed, what is the cause? Most of the variation is due to the changes in connection with the progress of the period of lactation. Just after a cow calves, the milk is the thinnest it is to be anytime in the year and it remains with but little change in quality, until the cow gets in calf again. Then as the quantity of milk gradually decreases the per cent. of fat slowly rises and the milk is richest in fat just before the cow goes dry. The extent of the variation differs widely in different cows. In my own experience I have had a cow that gave at first milk containing three and a half per cent. of fat, and just before she went dry milk of four and a half per cent. increasing only one per cent. Another cow just doubled from three and a half to seven per cent., while still a third cow on calving gave seven per cent. milk, and the last milking before she went dry tested over fourteen per cent. of fat—it was cream rather than milk.

Then, too, there is usually a variation between the quality of the milk produced in the morning and in the evening. The rule is that the richer milk is given at the milking that occurs after the shorter number of hours between milkings. If the milking is done in the winter at seven in the morning and five in the evening, the evening's milk will be the richer for there are only ten hours between the morning and evening milkings. In the summer when the hours of milking are reversed, the morning's milk will be the richer. After allowance has been made for all the above mentioned causes, there is still a daily and weekly fluctuation in the richness of the milk due to causes as yet unknown. But the fact of this variation is certain. I have found it in single cows and in large herds, when there was no assignable cause. I have isolated a fine healthy vigorous cow and treated her with exceptional care and regularity and yet she has varied a whole per cent. in the richness of her milk during a single week. This phase of the subject needs to be made prominent because a lack of knowledge of the fact has led to many a wrangle and much hard feeling at creameries that pay by test. Because your test one week is different from the week before, do not jump at once to the conclusion that the creameryman has made a mistake or is trying to cheat you. Either may be true, but the variation in the test is not proof of either.

The statement has been made that no change of feed will make the milk richer. It is easy, however, to lessen the quality. Any irregularity in the daily routine will be reflected in a smaller quantity —a change in milkers or in the manner of milking, a change in the time, place or order of milking—anything that is not expected or a

lack of anything that is expected by the cow will to a greater or less extent interfere with the perfect working of the cow as a machine. Fright has a powerful influence to take the fat out of milk. If the cow is driven to the barn by a barking cur, if she is beaten with the milk-stool for not standing still a less quantity of a poorer quality of milk is sure to result. If she stands out in zero weather until chilled or is compelled to occupy a cold stable, the owner is punished for his lack of kindness by a decided lack of milk and cream. In general, it can be said that anything that makes the cow uncomfortable in mind or body will both lessen the quantity of milk and decrease the per cent. of fat.

The quantity of milk can be varied between large extremes, and it can be said in general, that a cow of the true dairy type gives more milk, the more food she digests. The largest net profit is usually obtained by feeding a cow palatable, healthy and easily digested food, almost to the limit of her capacity.

If a richer milk is desired it must be obtained by getting a different cow. In concise language, obtain quality of milk by breeding and quantity by feeding. But remember that only good, wholesome food given in clean, healthy surroundings will produce a quality of milk, cream or butter satisfactory to the patrons, and that the kindly treatment which keeps the cow comfortable in mind and body is the only method that will return full value for the food consumed.

ROUND TABLE—SECTION A.

(CONDUCTED BY PROFS. MAIRS AND COOKE.)

PROF. MAIRS: Here is a man who asks me a question as follows: "Will the Prof. please explain a little his objection to shredded or cut stover?" I will explain that in this way. I don't know that I object to it seriously, but my objection to it is on account of the fact that an ordinary man compels cows to eat more shredded stover than is good for them. A cow will eat a lot of the indigestible portion, and in handling that, it takes some of her energies which should have been devoted to something else. Ordinarily she will eat a part of the tip that is left when the cow is fed the whole stover. It is not economical to make the cow eat that. She will often be compelled to eat that in the shredded stover. It would be better to throw that out and use it for bedding.

A Member: How is it about the butts of corn-stalks?

PROF. MAIRS: The butts of corn-stalks are also indigestible. It is generally believed, and has been very thoroughly demonstrated that the corn-cob with the corn on which it grows—there are certain products in there which were thought to be indigestible but

since then we have learned more about them. I would not advise a man to feed his cows on cob meal alone or to feed that entirely to the same animal, although I have heard of cases where animals have been brought through the winter on nothing at all but corncobs.

Do not understand me as condemning shredded stover. It is a good thing, which can be fed to advantage, but I believe often the cows are compelled to eat more than is good for them. I may be wrong in this. Shredded stover must be shredded for feed in the stable. I do not believe that the cows ought to be compelled to eat much of that portion which they would not eat if they were fed the whole stalk.

MR. KAHLER: I was not here during all this talk in regard to silos, but up in our country we have had early frosts which has caused a great deal of silage to be badly frozen. Now, in your opinion, how much loss is in that?

PROF. MAIRS: I do not know and I do not know whether anybody knows or not. It would be deteriorated some; the quality of the corn has been deteriorated some, since it is dry it will not keep so well in the soil, but if thoroughly wet the keeping qualities will be increased somewhat. I don't know how much it has deteriorated. Maybe Prof. Cooke can tell us more about that.

MR. SEXTON: My experience has been that the best possible way to preserve our ensilage corn, if we get it cut by a frost, is to put it into the silo as soon as possible. We have had experience along that line some years, and have found that the frosty ensilage corn was very little damaged if we put it into the silo at once; we could tell more particularly about it in this way, that part of it only was frozen, and we never could see any difference in the feeding qualities of that silage.

I want to ask the gentleman a question in reference to turning cows into the yard on cold blustering days. Down in our part of the State where we are furnishing milk to the city, and want to keep up about an even quantity each day for our milkmen as they require it—I want to ask why we should turn our cows into the yard to give them exercise, no matter whether it is blustering or not, when we know by actual tests that those animals will shrink in milk. If we leave them in the yard for a few hours even, they will shrink from one to three pints each. Now I want to know why we should give them exercise when we have that experience.

PROF. MAIRS: If that is the actual result, they should not be turned out there. Cows need exercise, but where that is the actual result, under such circumstances I should not advise it. We started

in to demonstrate the folly of keeping cows exposed or turning those cows out on cold nights and letting them stay outside the stable, in cases where the custom had been to keep them in. I know of one man that kept a record along this line and he found when he went to look over his figures that when these cows had been out at night he got more milk in the morning than he did when they had been in the stable. I say that if the cows go off in milk, then the proper thing to do is to keep them in, but it has not always been by observation that they go off in that way.

MR. SEXTON: I will admit that in warm weather you will not see so much of that shrinkage, but if we take the cold winter months, such as we have, our experience is that we can produce very much larger quantities if we keep our animals quietly in the stable without any excitement or noise or confusion. The more quiet we keep our animals, the better results we get. We are coming down to the conclusion each year that the more care we take and the more quiet handling we can give the cows, the better will be the results.

MR. CLARK: Might it not be a matter of the healthy condition of these cows? Suppose a cow was kept housed up for quite a number of weeks, in the stable, confined to it without any exercise, now might we not on the other side, take the cow that had a certain amount of exercise even though it might be a little cold, the question is, would it not affect the healthy condition of the cow—would one over-balance the other?

MR. SEXTON: That is certainly a matter that we want to take into consideration. I was only speaking of the shrinkage of the milk that would come to those animals, when we give them that exercise in cold, winter weather.

MR. LIGHTY: We want to be right about this matter. We go before the farmers of Pennsylvania and thousands of these little things practically come up all over the State. I am sorry that I missed a good deal of this talk. I understand that there is a little controversy whether we should go out and advise the farmers to cut their corn fodder up fine or shred it so that the animals can eat it, and whether you should let them out in the field or in the yard as some of us do on the other side of the hills.

Now we have been going over the State and trying to induce those people to cut and shred that corn fodder, make the very best use of it possible; we have been talking along that line that they should do that, cut it with the greatest care, shock it up, tie it up, house it—not let it lie there in the field—put the water on and scald it; we have been trying to get them to build silos; now are we wrong? Did we advise wrongly when we particularly stated that the cow never

does better than when conditions are absolutely as uniform as possible?

Let me give my theory. As I said yesterday, it just comes back to the question whether we shall give too much of our personal, practical experience on the farm, or talk on general principles. I believe we ought to urge the farmer to weigh the milk every day. I disagree with Prof. Cooke on that point. I have weighed my milk for twelve years.

Now coming to this point, when we turn our cows out, after getting some insight and hearing some lecturer tell us we were losing milk by exposing those cows, I turned those cows out for a week to test this matter and then I took pails made out of galvanized iron and carried water to their mangers and weighed and tested and found that it paid me a return of about $5 a day to carry that water to those cows in that stable and not let them out at all, and I went to work and put devices in so that they have water in the stable right along, and they don't get out at all from fall until spring, that is, if I am at home and attending to my business.

MR. KAHLER: As I understand it, the idea is, if you exercise the cow, the energy required for the exercise will reduce the energy that goes to milk production, and she will give us less than if we keep her perfectly quiet. Probably by keeping her perfectly quiet she will give you a little better results. The question arising in my mind is, whether you are not endangering the cow? The cow was never created to be put in a band-box, and I believe that for the benefit of the general health of the cow, that she ought to have a certain amount of exercise at the proper time. I believe that in my experience that if the cow did not move a foot that probably she would give a little more milk, but I also believe that if you keep your cows entirely without exercise, as some men recommend, you will make a very short-lived cow. I think there are two sides to this question, and that either side can be abused.

PROF. MAIRS: I am glad to hear the experience of Mr. Lighty and Mr. Sexton with their dairy herds; I am glad that I have got some one stirred up on the subject. I had hoped to when I mentioned that subject of exposure and the subject of shredded stover too.

DR. ARMSBY: I just want to offer a suggestion. I think possibly, Mr. Lighty, one important element at least when we speak of uniform conditions—keeping a cow under uniform conditions from time to time is important. Some six months ago I visited the Experiment Station in Illinois. They have there a very good cover, a closed barnyard, roofed over. They told me in their experience

they kept their cows in that closed barnyard all the time where they were exposed to a good deal of colder weather, not to rains or severe winter weather, but a good deal lower temperature than they would be in the barn. They said their experience was that cows gave just as much milk and did just as well in that colder, somewhat sheltered place, than in the barn, but if they turned them out there for a few days after they had become accustomed to a warm stable, there was a very considerable milk shrinkage in them.

I presume that a uniform condition is just as important as the exact conditions themselves. They told me further that a cow kept out in this cold barnyard—that those cows protected themselves against the cold to a certain degree, while if kept in the barn, their coats would be thinner. I think uniformity of condition is of some importance. The mere matter of supplying fuel to keep up the animal heat, I don't think that cuts any great figure. There is no question that a cow produces more heat than she needs to keep her body warm. We have pretty well established the fact by experiments here that a moderately low temperature is rather advantageous than otherwise. I do not think that turning a cow out in a cold barnyard would have any effect causing her to eat up more fuel to keep warm.

A dairy cow varies from the steer in this: She uses her fat for two distinct purposes. She may put it into her milk, or may put the fat on her ribs, if you expose her to cold. The tendency is to check the milk production; that is likely to be the tendency, and while she may really produce just as much, you turn her from milk production to fat production. I am not sure that the same thing may not be true to a certain extent in the matter of exercise.

There have been some very instructive papers published by some Germans on exercise of dairy cows. They use the cows over there for working animals so that the conditions differ. In two or three cases experiments have shown these results, that the cow, worked moderately, showed no diminution in milk supply as the result of that amount of work. That is, the general result of the experiments indicated that the tendency is, if anything, to make the milk a little better in quality than when cows were kept tied up in the stable. I do not think these few results are to be generalized from on the basis of the experiments made. The conditions are pretty complex, but I am inclined to think that uniformity of conditions may be quite as important as the temperature itself. If you are shifting her back and forth, you are liable to have trouble or you may turn the production from milk to fat or beef.

MR. HERR: During our institute last winter, Mr. Detrich made a very radical statement in regard to a cow chewing her cud. I would like to ask Dr. Armsby to what extent the exercise of chewing her

cud will answer instead of the other exercise—without the other out-door exercise we have heard spoken of?

DR. ARMSBY: I do not know that I am prepared to answer that. Undoubtedly a good deal of muscular exertion is put into chewing the cud from a hygienic standpoint. I do not think that one of us would like to take this exercise by working his jaw in that way.

MR. HOWDEN: I think that what Dr. Armsby said as to conditions, covered a good deal of ground. It makes quite a difference whether a cow goes out into a barnyard near by—into a covered shed or uncovered and drinks spring water at a temperature of 48 degrees, or whether she goes to some pond or pool where the ice has been previously broken and drinks ice-cold water.

MR. DAVIS: I would just like to ask one question: Whether keeping these cows stabled all the time would not have a tendency to weaken the progeny of the cows?

PROF. MAIRS: I do not know that anything definite can be said on that. We do know that animals do tend to adapt themselves to their conditions. The probabilities are that they would become more tender by their ancestry being kept in a stable.

QUESTION: "Does milk take in odor more while warm or after being cooled?"

PROF. MAIRS: I should say that milk takes in odor more while warm than after being cooled, for the reason, as Prof. Cooke said, that there is a circulation of air. While the milk is warmer than the air, particles of air coming in contact with the milk will carry the odors in from the outside, while if the milk has the same temperature as the surrounding air, the milk will not change. I know of an experiment where a pail of milk was set in a well over night and in the morning the milk was tested by a number of processes and, although it had been exposed to the oders of silage, no silage taint was detected in the milk.

QUESTION: "Is gluten meal a good feed to buy for protein when one has corn and oats chop for a grain feed to feed with corn stover and clover and timothy hay mixed?"

PROF. COOKE: In answering that question there are several things to be understood. It don't affect the quality of the milk at all. The gluten on the market to-day is an entirely different by-product—has very much less oil in it than the commercial gluten meal. The commercial gluten meal is the germ of the corn plant, whereas the gluten meal you get now is the germ and the corn com-

bined. At the present time I consider gluten meal and corn stover one of the very best feeds for the production of milk. I consider that gluten meal is among the very best of the dairy foods.

QUESTION: "If the flush of feed does not affect the butter-fat-content of milk, does the flush of feed change the cheese-content to the milk?"

PROF. COOKE: The present idea is that the cheese-content and butter-fat-content rise and fall simultaneously. Take milk between three and a half per cent. and four and a half per cent. of fat and the probabilities are that the butter value and cheese value will rise and fall almost exactly the same. Then when you get milk higher than four and a half per cent.—when you get up to six or seven per cent. in milk, the cheese value probably does not rise quite as far as the butter value.

QUESTION: "Does the application of the milk-stool cause the cow to retain a certain amount of butter-fat, or is it because she retains a portion of her milk that contains the greater portion of the fat?"

PROF. COOKE: It seems to be the fact that she just holds up the strippings, does not let down the last part of the milk. Of course you know the last part of the milk is the richest.

MR. HOWDEN: Don't you get it the next milking?

PROF. COOKE: No, you don't. I don't know why, but I know the fact that you don't.

QUESTION: "What is the proper height of an ideal cow-stable?"

PROF. COOKE: Well, a stall— I don't know the exact measurement—the Bidwell stall is about four or four and a half feet high; I think it should be high enough so that there is no danger of the animal getting over it. The less material you have in it, the better. If a stable is meant, it should not be lower than eight feet anyway, and ten feet would be better. There is no necessity of its being higher than ten feet that I know of except where there is no loft over it, then of course, in the center, under the cone, it must be higher.

QUESTION: "Will cows produce more milk at three milkings in a day than at two if milked at regular intervals?"

PROF. MAIRS: I am inclined to think, in general, they will, but not enough more to pay for the extra milking. There are some cows which it is found necessary to milk three times a day when giving a very large quantity of milk, but for an ordinary cow it is not

necessary; still I am inclined to think that for many cows, specially those giving a large quantity of milk, that they will give more if milked three times a day.

MR. RIDDLE: I asked the question for the reason that while visiting the World's Fair at St. Louis some time ago I was very much interested in the milk tests going on there, and became acquainted with a number of the gentlemen who have animals in that test, and I noticed that they milked three times a day, dividing the day into eight hour periods. I asked the reason and they said that they got more milk than they would by milking twice a day.

PROF. MAIRS: I believe that is true, because all those cows are giving a large quantity of milk.

MR. SEXTON: I want to say right here that we have had a good deal of experience in that direction in the making of milk records when the attempt was to secure the largest number of pounds of the milk. We didn't care so much about the quality if we only got pounds, and we found that in three milkings a day we could increase very largely, and that the cow that made the largest record for milk production ever put on record, was milked four times a day.

QUESTION: "Has the milk-pail, sketched on the board, any special advantage—any sanitary advantage?"

PROF. MAIRS: It is supposed to keep out the dirt and hair, but it has the unsanitary disadvantage that it is difficult to clean, because of the fact that there is so much mechanism about it. I do not recommend that one.

MR. MARTIN: As visitors, we no doubt will be interested in going through the Carnegie Library which will be open after the hour of 2.30 o'clock this afternoon, so that those who desire to avail themselves of the pleasure of going through the library may do so at any time after the hour named. This auditorium will be the place of meeting this afternoon and to-night, and during the interval at noon and this evening—between our sessions—this auditorium will be open for rest and sociability.

Adjourned to 2.30 P. M.

PROGRAM—SECTION B.

State College, Pa., Thursday Morning, Oct., 13, 1904.

Z. T. CURE, Chairman.

The CHAIRMAN: The audience will now come to order. We have a very important subject to-day, "Market Gardening," and we have

a very competent man to handle it. I introduce to you Prof. R. L. Watts.

The following paper was then presented by Prof. Watts:

MARKET GARDENING.

By Prof. R. L. Watts, *Scalp Level, Pa.*

Market gardening relates to the production of vegetables for commercial purposes. There are comparatively few market gardeners, those whose main business is the growing of vegetables for market, but the great mass of our farmers do more or less market gardening. They may be dairymen, but the surplus of produce from the kitchen garden is sold and adds materially to the total receipts of the farm. They may be general farmers or specialists, but vegetables in greater or less quantity are sold from nearly all the farms of our State. This is the practice because it pays and every industrial farmer is working for the greatest profit. There is no reason why receipts should not be materially increased on many farms of our State by raising more vegetables which find ready sale on local and distant markets. Millions of dollars go out of our State annually for onions, cabbage, tomatoes, celery and many other vegetables that might be grown most successfully in Pennsylvania. It is hoped that the following remarks will be particularly helpful to young men who are anxious to make their farms pay a real profit.

THINGS TO WORK FOR.

The first thing to work for, is quantity or a good yield. There are certain items of expense that are practically uniform whether the crop is large or small. The gardener is compelled to expend almost a fixed amount for plowing, harrowing, cultivating, hoeing, etc., and there must be a fair crop before these expenses will be covered. To clear a profit, the yield must be more than fair; it must be, at least good, and large profits usually come from large yields. Early planting, thorough tillage and liberal feeding are the most important elements in securing large crops. Too much effort can not be made in working for quality. This is what secures fancy prices or even paying prices. Quality usually, not always, accompanies quantity. The rapidly grown vegetable is usually the best so far as palatability is concerned because it is the most succulent. The variety and character of the fertilizers used have much to do with the quality of the products. Earliness is of vital importance. Reaching the market a

few days later than necessary may mean quite a loss. It pays to get the vegetables on the market at the earliest possible date. Having produced a vegetable of good quality and at the proper time, see that it is put on the market in the most salable condition. Exercise great care in cleaning, grading and packing. Give full measure and see that the quality of the product is uniform throughout the package. Better put the poor on top than at the bottom; but it is still better to place all inferior specimens in separate packages or feed to stock. Do not be afraid to ask a reasonable price for a good article. Exercise business sense and judgment and you will be respected and patronized.

EQUIPMENT.

No large sum of money need be expended for equipment more than is found on most farms. Every good farmer is supplied with horse implements necessary to prepare and cultivate the soil and these are all that will be required in the culture of many vegetables. A seed drill and a hand cultivator are useful and necessary tools in growing such vegetables as onions, beets and radishes. Hot beds and cold frames are indispensable in starting early vegetable plants unless a greenhouse is available.

CONSTRUCTING HOT-BEDS AND COLD FRAMES.

The pit for the hot-bed should be dug in the fall before the ground is frozen. It should be about two feet deep, six feet wide and long enough to accommodate the number of sash to be used. The pit should run about east and west. The sides should be boarded, the top of the frame being above ground, six inches higher at the upper side than the lower and sloping to the south. If the sash are 3x6 ft. in size, there should be 2x3 cross supports on the frame three feet apart.

Fresh horse manure, containing considerable litter, should be used to fill the pit. About two weeks before the time when it is desired to sow the seed begin the preparation of the manure. Tramp compactly in piles about six feet square and four feet deep. A sheltered place from rain and snow should be used for this work. When the pile of manure is thoroughly heated, which will require probably three or four days, fork it over and make another stack, placing the outer portions of the manure in the interior of the second stack. When the pile is again thoroughly heated, throw into the pit, tramp firmly and fill to within six inches of the top of the frame. Now place the sash on the frame, and plunge a thermometer into the manure. When the temperature of the manure as indicated by the

plunged thermometer subsides to 95 degrees, it is safe to sow the seeds.

Cold frames are made of boards or planks set on top of the ground and given the same slope as hot beds. They should always slope to the south, southeast or southwest. It pays to make the frames of sound, durable lumber. The sash should invariably be made of cypress or cedar, the joints being leaded before putting together. Keep them well-painted and stored in the dry when not in use. There are many factories in the country where good cedar or cypress sash can be bought glazed or unglazed, and they are so much superior to pine sash made in local factories that it is never desirable to purchase the latter.

THE USE OF HOT-BEDS.

Hot-beds are used to start all vegetable plants with which earliness is especially important, as lettuce, cabbage, cauliflower, tomatoes, egg-plant, peppers, celery and other vegetables. The first sowing of cabbage, cauliflower and lettuce seed should be made about February first or even earlier in the eastern part of the State. The practice of many gardeners is to place a few inches of good soil directly on the manure, depositing the seed in this soil rather than in flats placed on the manure. It is much more convenient, however, to use flats. These shallow boxes or flats are made by ripping small boxes into sections about two inches deep. Boxes in which canned tomatoes and soaps have been shipped are very convenient forms and sizes. The bottoms of the flats are usually made from thin lumber of large boxes the pieces of which are long enough to make two lengths for the bottoms of the flats. It is a temptation to make these flats three or four inches deep, but they are of little or no advantage over those only two inches deep. We have used various depths, and just as good plants have been grown in the shallow flats as in deeper ones.

The soil for starting the young plants should be light and loamy in character and, at least, moderately fertile. Foresight must be exercised to store the soil in the fall before the ground is frozen. If the hot-bed is small a few barrels of soil stored in the cellar will answer the purpose. If operations are to be quite extensive, a large pile may be hauled into a warm stable or cave. When cabbage plants are to be started, special care should be exercised to get soil free from the disease-germs which cause club-root.

When the time for sowing has arrived and the temperature of the manure in the hot-bed is not more than 90 degrees, fills the flats with soil (which has been screened, if very gravelly), pressing firmly, especially in the corners and along the sides. The sides may be sown

broadcast or in rows, the rows being about two inches apart. Shallow furrows are made by pressing the edge of a piece of plastering lath or other small strips into the soil. Sow about one hundred and fifty seeds in each furrow or sufficient to make 1,000 plants per flat. Stronger plants will be procured if they are sown more thinly, but by good management the above number of first-class plants may be procured from a flat made from a Star soap-box. After sowing the entire flat or number of flats to be used, place in the hot-bed and water thoroughly, or if more convenient, water before setting in the hot-bed.

Now remove the thermometer plunged in the manure of the hot-bed and lay on the edge of a flat. If possible do not allow the temperature to rise higher than sixty degrees, and a lower temperature will make much stronger plants. Cabbage, cauliflower and lettuce seeds will germinate at a temperature of 45 degrees and a slow germination and slow growth always result in better plants. This is a strong argument in favor of early sowing so that it will not be necessary to force the plants too rapidly. Ventilate freely when the weather permits and make moderate applications of water only when absolutely necessary, shown by the plants wilting or by them refusing to grow fast enough. Every precaution must be taken to prevent the plants from damping off. It should be constantly kept in mind that high temperature and excessive moisture are the two chief factors in promoting this disease.

THE USE OF COLD FRAMES.

In about four weeks the seedlings will be ready to transplant. The flats described are also used for this operation. They may be filled to within half an inch of the top with thoroughly rotted manure or compost, filling the remainder of the space with fine rich soil. A large quantity of manure in the fall is a decided advantage in transplanting as it will hold together and the plants may be transferred to the field with less damage to the roots than if only soil is used. In transplanting to the flats make the holes from an inch and a half to two inches apart with a dibber or small, sharp stick. A very rapid method is to use a board in which check rows have been bored with a three-quarter inch bit. After filling the flat and pressing the soil firmly, place this board over it, hold securely with the left hand, and with dibber in the right hand punch the holes. Then place the flat carefully on a bench or table, drop a plant in each hole leaning them away from you, and fasten with the two thumbs and forefingers, or with the left thumb and forefinger and a small sharp stick in the right hand. See that the small plants are well-fastened. The soil should be sufficiently damp before transplanting so that

watering will not be necessary for at least a week or ten days. This is a decided advantage in preventing the damping off of the young plants. Fit the boxes in the cold frame so that little or no space is lost, ventilate freely when the weather permits and water when necessary. It is important to watch the corners of the flats, as the soil drys much more rapidly than in the interior of the boxes.

PROTECTING THE PLANTS FROM COLD.

Transferring to the cold frame usually begins about the first of March. The nights are always cold at this season of the year and it is necessary to make some provision for the protection of the plants. Nothing is better than burlap or rye straw mats. We have used the latter with entire success and have kept plants in cold frames with no bottom heat during zero weather. If the sash are 3x6 feet in size the mats should be 6x6½. Each mat will then cover two sash and lap over the ends of them to prevent the cold from entering along the sides of the frame. The mats are made quite rapidly if long straw is used. Two men will make five or six a day. To make these mats, proceed as follows: Prepare a frame 6x7 feet in size. Place it flat on two trestles at convenient working distance from the floor. At each end of the frame, near the edge, bore 7 three-quarter inch holes, the space being equal between them. Drive in each hole a strong peg. Stretch tightly between these pegs seven strands of the best quality of tar-rope. Take seven other strands and tie to the pegs at one end of the frame. Place small bundles of straw tops overlapping across the stretched ropes at the end of the frame, pass the second lot of ropes over the bundle, down under the stretched cords and up again, drawing as tightly as possible. Proceed in this manner until the mat is complete. Tie the ends of the ropes together, trim the mat and it is ready for use.

HARDENING THE PLANTS.

Cabbage, lettuce and cauliflower transplanted in the cold frame about the first of March should be large enough for the field by the first of April. To take them direct to the field from their warm home under the glass would prove disastrous to the tender plants, unless they were first subjected to a hardening process. This must be gradual. Begin by ventilating more than usual in the day-time, in a day or two remove the sash entirely through the day, then do not cover sash with the mats at night and finally give no protection during either day or night. If the plants are thoroughly hardened in the frames they will stand severe freezing in the field. This is true of the three vegetables named. It is also a decided advantage to harden tomato and other tender plants before setting in the field.

SOILS ADAPTED TO GARDENING.

Certain districts of the country are exceptionally well-adapted to maket gardening because of desirable soil characteristics. Long Island, Kalamazoo and other sections are famous for the immense production of certain classes of vegetables. The amateur gardener is liable to conclude, from the great success attained in these favored districts, that he cannot expect more than fair results under less favorable conditions. This is far from being correct, however, for better markets and market facilities may secure for him even larger profits than is possible in districts with better soils. The fact is that almost every Pennsylvania farm contains areas of soil on which some vegetables may be grown to the highest perfection. Most of the vegetables may be grown successfully where general farm crops have been a success. The mechanical or physical properties of the soil are of greater importance than the chemical. The soil should be loose and friable, and stiff soils may soon be improved in texture by the addition of lime and vegetable matter in the way of manure and green crops. The soil shoul be well-drained but retentive of moisture. Moisture is the most important factor in securing large crops, and gardeners should strive for that mechanical condition of the soil which will enable it to retain a liberal supply of water to meet the needs of growing crops.

PREPARATION OF SOIL.

Thorough preparation of the soil is of the greatest importance. Stiff soils and heavy sods should be plowed in the fall. The work of pulverization must not be slighted. Following the plow, a plank drag can often be used to the best advantage. Either a disc or cut-a-way harrow used alternately with the drag will generally reduce the soil to the proper fineness. It is folly to begin planting before the ground is ready. So much is gained by the most thorough pulverization that the gardener cannot afford to neglect this work.

MANURE AND FERTILIZERS.

Liberal feeding counts for much in market gardening. Those who have reaped the largest profits in gardening have used immense quantities of both manure and commercial fertilizer. A common practice with gardeners, following an intensified system, is to apply 50 to 75 tons of manure per acre besides one to three tons of commercial fertilizer. It is not necessary for farmers with plenty of land to use plant food quite so freely as this. Fifteen to twenty-five loads of manure per acre and 1,000 lbs. to 1,500 lbs. of high-grade fertilizer should give splendid results on soils which have been producing good field crops.

Our own practice is not to purchase complete fertilizers but to procure rock phosphate, bone meal, nitrate of soda and muriate of potash, mixing on the barn floor to meet the needs of each crop for which it is to be used, at the same time taking into consideration the previous treatment of the soil to be cropped. If manure has been used freely for a crop of cabbage, very little, if any manure is applied to this land if it is to be planted with tomatoes. Excessive quantities of manure causes too rank growth of plants and the crop will be small and late. Applications of potash and phosphoric acid are always beneficial for tomatoes and it is safe to use these elements quite freely. Bone meal placed in the hill at the time of transplanting any vegetable in the field is highly beneficial. Nitrate of soda can often be used to advantage as a top-dressing about the plants after they are established. If applied before a shower at the rate of a teaspoonful about each plant, the good effect may be seen almost immediately by the plant taking on a darker green color. For actual cost of nitrogen, nitrate of soda is usually the cheapest form, but it must be used skilfully to prevent loss by leaching.

TILLAGE.

Profitable market gardening requires thoroughness all along the line. The haphazard method employed by some general farmers in cultivating their crops will absolutely fail to secure even fair results in the production of vegetables. Cultivation should begin at the earliest possible moment after the crop is started and repeated at frequent intervals. If the horse or man-labor on the farm is not sufficient to care for the field crops as well as the garden crops it is important that additional labor be employed.

It is not possible to enter into a detailed discussion of the essential points in the culture of the various garden crops. There is a great profusion of literature on subjects pertaining to gardening and it may be procured at very little cost. The Farmers' Bulletins of the United States Department of Agriculture may be had free of charge and many of them relate to the culture of garden crops.

ROUND TABLE—SECTION B.

(Conducted by Prof. Watts.)

MR. SCHWARZ: Why do you put yield as one of the points ahead of quality?

Answer: Many beginners do not get enough produce to make a profit from the crop. You must have yield first.

MR. SCHWARZ: The beginner must consider quality first if he wishes to establish himself in business.

MR. PHILIPS: The difference is in the markets of the two men. Mr. Watts has the market of the city of Johnstown; Mr. Schwarz has the markets of Philadelphia and New York. One class of people require and will pay for an article which the other will not.

MR. SCHWARZ: I insist on quality in whatever one does.

MR. DRAKE: In your intense manuring are you ever troubled with cabbage bursting?

Answer: I would get the cabbage off to market before it has a chance to burst. Plant a little later if you are troubled with bursting.

MR. SCHWARZ: If your cabbage bursts, it is generally after a rain. Kick all your heads sidewise and you will have no bursted cabbage.

MR. SCHWARZ: Would you qualify your statement as to putting cow manure with horse manure?

Answer: Don't use large quantities of cow manure, but a small addition of it will prolong heat in the hot bed.

QUESTION: "Would you recommend pasteurizing soil in hot-beds and cold frames by the use of boiling water and heat?"

Answer: Investigation does not show that that is practicable. In answer to an inquiry, the Department of Agriculture said that nothing definite had been discovered along this particular line. You would be likely to destroy, with the disease germs, the elements of fertility. These, however, could be replaced by the use of commercial fertilizers

MR. THAYER: Are you troubled much with fungus in fresh soil?

Answer: Spraying with Bordeaux mixture is recommended as a remedy.

MR. SCHWARZ: Is not that largely due to defective drainage? Don't use soil in which cabbage has been grown the year before.

PROF. SURFACE: Any trouble with black rot?

MR. SCHWARZ: Only on cauliflower and we overcame it by spraying with Bordeaux mixture.

PROF. WATTS: If the drainage were imperfect that would add to the trouble. All our diseases are caused by germs. Excess of moisture in soil or atmosphere would make it worse.

PROF. SURFACE: Is there no remedy for black-rot?

PROF. BUTZ: The use of fungicides is not very satisfactory. The best treatment is to remove and burn the entire diseased cabbage or cauliflower plants as soon as the disease is recognized.

MR. DRAKE: Any trouble with cabbage maggots?

PROF. WATTS: Not to any extent. Dr. Thayer can enlighten you on that subject.

DR. THAYER: When I can get my cabbage out before May 1, I have not been troubled, but when I am coming into May I get the maggot. It is easily disposed by using carbon bi-sulphide. Thrust a dibber down, slant it under the root, drop in about a drachm and close the earth quickly. The way to get rid of that maggot, is to get your cabbage well started before it appears in May.

MR. WYCKOFF: While I am not extensively engaged in growing cabbage, my experience with the maggot is directly opposite to that of the last speaker. Early in April the cabbage plants were placed out in the field and I lost about 75 per cent. of them, not knowing at that time how to fight them. Plants of the same variety and taken from the same bed later, plants that were not so well-developed, I had no difficulty with whatever. Why did the maggot destroy the first plants in the plot where cabbage had not been raised for three or four years?

PROF. SURFACE: There are two broods of these flies per year. They come within a range of two weeks time. There is a period in which the flies do not plant their eggs. If you plant during that period, your cabbage will not be infected.

MR. SCHWARZ: Use muriate of potash. I have watering-pots with long spouts into which I put a solution of muriate of potash and apply it in a very fine stream. We saved the entire field by this method.

PROF. SURFACE: Salt is effective. Apply a thimbleful of salt close to the root of each plant. It is better than Paris green because it would penetrate while the Paris green would have to be absorbed. Carbon bi-sulphide would work in a firm soil, but would not be effective on a loose or sandy soil.

MR. SCHWARZ: Succession is the last cabbage I would recommend for early.

PROF. WATTS: I simply grow Succession cabbage because it is one of my best paying varieties. Seed should be sown early.

PROF. WATTS: I stated that quantity should go before quality. What is the use of my growing 250 barrels of Early Summer, when Succession will make at least 300 barrels per acre on soil of moderate fertility.

MR. SCHWARZ: If Watts can grow plants in a half-inch of soil it is more than I can do.

PROF. WATTS: The plants do not grow in the soil alone but mostly in the manure under the soil.

The CHAIRMAN: We have a very interesting topic and a very able man to treat it: "Insect Prevention." I will not introduce Professor H. A. Surface, who will discuss the subject.

Prof. Surface presented the following paper:

INSECT PREVENTION.

By Prof. H. A. Surface, *Economic Zoologist, Harrisburg, Pa.*

In avoiding the ravages of insects it is as true, as in preventing other losses, that "an ounce of prevention is worth a pound of cure." It is possible by practicing certain methods to prevent the occurrence of many kinds of insects, some of which may never be remedied after they once appear. An example of this is the Hessian fly. There is no known remedy for this after once present in the wheat, although it is possible by two or three methods to prevent the occurrence of this insect.

The difference between remedy and prevention, therefore, is this: A remedy is a means that is applied to become rid of a pest or trouble after it is present; while a prevention is to be regarded more as a means of insuring against the possibility of its occurrence. It is easier to prevent the appearance of many insect pests than to remedy them, and it is also more certain and satisfactory. No one means of prevention will ever be found effective, but if the various methods that we here outline be closely followed, it is evident that combinations will result satisfactorily.

For system in treating the subject, it is here divided into four sections. In the first we deal with *farm practice*, which means good

farming by various modified methods. One should be able to produce good crops, and at the same time avoid pests. This is the most important method of preventing insects, but it is so complex that it in turn must be treated in several sub-heads.

(1) Rotation of Crops. Every farmer knows that this means avoiding the continued growth of one kind of crop upon the same land. We have invariably found pests to be most abundant in those fields where the same crop had been tried more or less continuously for years. The worst infested timothy field I ever saw was one that had been kept constantly in this kind of grass for sixteen years. Clover fields generally die out in a comparatively short time, since the various kinds of pests that attack them become so abundant as to effect their destruction. The rotation of crops is especially desirable for such insects as root lice, and flea beetles, and others that do not travel any great distance. The flea beetle, which is often so injurious to both the leaves and tubers of potatoes in its adult and larval stages, respectively, is an example of an insect that should be prevented by rotation of crops, rather than remedied by any means that may be suggested. The necessity of rotation of crops is also to be emphasized in considering other insects, such as wireworms and cutworms, that live in the soil. This kind of rotation is important, for example, where corn is to follow sod. One should anticipate the attacks by cutworms and wireworms and thus prevent their occurrence. In knowing that such attacks are likely to occur he may prevent them by certain farming methods, which we shall give presently.

Parallel with rotation of crops, we should call attention to the necessity of planting crops upon some portion of the farm not immediately adjacent to a field in which the same kind grew during the previous year. Many insects, such as the Hessian fly, are able to travel the short distance, but do not readily travel a great distance unless unusually favorable conditions occur. The practice of growing large areas of one kind of crop is also tending toward the increase of diseases and enemies of that kind of crop. For example, where peas have been grown in great quantities, there both pea lice and other pests of this particular plant have multiplied and proven especially destructive as a result. Where asparagus has been grown upon an extensive scale, the asparagus beetle and rust have been found most disastrous, and where much celery is cultivated there are to be seen celery caterpillars or striped worms, also rust, blight, etc. This applies to the enemies of most other crops, especially tobacco, potatoes, tomatoes, etc. Thus by rotation of the kind of crop, and by planting in a region where pests of that particular kind of crop have not occurred abundantly, such pests may be avoided.

(2) A careful selection of stock for growth is very important,

whether this be seeds, plants or live stock. These should be examined to be sure that they are free from pests. For example, if peas and beans be infested with the weevil, or if wheat bought for seed be infested with granary pests, these insects are thus introduced into the premises, and are sure to be in readiness to attack the new crop in due season. Plants that are imported for growing, such as cabbage, tomatoes, sweet potatoes, strawberries and others, should be examined to be sure that there are no lice or other pests upon the leaves, stems or roots, or within their tissues. Many fine strawberry beds have been ruined by introducing into them new plants which had strawberry lice upon the roots. It is far better to avoid this by examining the new plants and rejecting the entire lot among which even a few pests may be found.

The importance of a careful selection of fruit trees can not be too greatly emphasized. The San José Scale has been introduced into nearly all the counties of our State solely upon nursery stock brought to orchards and planted there to bear fruit. Various other pests of fruit and ornamental trees are brought into our State upon infested trees, shrubs, and other plants, and it becomes almost impossible to eradicate them after they are once present. A rigid system of selection and inspection is the best means of preventing such pests. If a grower does not know his enemies, let him be on the safe side, and suspect every creature as being obnoxious until he can submit specimens to specialists and learn the truth.

In examining live stock for parasites, this also becomes very important at times. At this date there are herds of cattle in Lancaster county, as well as in Berks county, infected with Texas Fever, because animals infested with the cattle tick bearing this disease-germ have been introduced into the herds. If inspection had been made for cattle ticks, and the live stock rejected upon the first evidence of their occurrence, the Texas Fever would have been avoided in these herds. In this case it can be seen how much more important is prevention than remedy.

The selection of resistant varieties of plants is also important, as the American varieties of grapes for avoiding Phylloxera, Uruguay potatoes to avoid blight and rot, Dawson's Golden Chaff wheat for avoiding Hessian Fly, Kieffer pear (though a poor variety) for San José Scale, etc.

(3) The dates of various farm operations are found to be important in preventing the occurrence of insects. This may at first seem strange, but let us cite examples: For cutworms or wireworms no remedies are entirely satisfactory; but is a preventive, one of the best measures is plowing and cultivating the soil in the late fall, as late as possible, and in early spring, as early as possible. These insects are in the larval stage in the ground, during winter, and if the

soil be stirred at such time of the year that it will come in contact with them where they are too cold and stagnant or dormant to escape it it will freeze against their bodies and kill them.

The date of seeding is also very important. As for example, in sowing wheat late to avoid the Hessian fly. In this State no wheat should be sown before the middle of September in the northern part and the first of October in the southern portion of the State. This is the best recommendation that can be given for preventing the injuries by this pest. However, it should be remembered that late seeding does not mean late plowing. The ground should be plowed early and put in the most perfect condition. A careful preparation of the seed-bed is always of great importance in giving vigor and growth to the plants, and consequently in making it possible for them to have strength to overcome the effects of their enemies. The date of setting out plants becomes important to avoid the enemies. It is possible, for example, to set cabbage in the spring at just such time that the cabbage root maggot or worm will attack it, because it will be the right date to receive the eggs of the fly from which this worm hatches. It is also possible, however, by planting cabbage a little earlier or just a little later to avoid the attacks of this pest, because the eggs of the flies will have been laid at the time of this planting. This is not only theory, but is the result of practice of persons giving us reports of such work.

The date of cultivation and the amount of cultivation become very important in preventing and destroying insects. For insects in the soil the more cultivation that can be given plants, the better, because pests are destroyed by that means, and plants are invigorated. The date of gathering a crop may vary according to the methods, the occasion, etc., and may be made such that serious pests will be destroyed or prevented. As for example, in destroying the clover seed midge, and preventing the occurance of a second brood. This midge feeds in the larval stage in the young seed in the base of the blossom of red clover. One midge is at each single floret, but a hundred in a head. Where we see clover blossoms mature imperfectly, and only a few florets, or sometimes even none properly developed in a head, it means that this midge is present in destructive numbers. If clover be cut a week or two earlier than usual the midge is killed by being brought to an untimely end, but when clover is permitted to remain until fairly ripened or almost ripened, as in accordance with the usual time for cutting clover, the midge falls to the ground and is ready to go into the pupal state there and emerge as a winged creature a short time later. It then lays its eggs in the heads of the second crop of clover, and thus destroys the seeds of the crop which we wish to mow and thresh for seed. It can be seen that early mowing of the first clover crop kills the midge in its worm stage, prevents

its appearance to infest the second crop, and thus insures seed by a means better than any other that can be recommended.

(4) The immediate destruction of unused parts of plants and all fallen fruits is imperative if one wish to avoid their diseases and pests of plants of this kind during another year. For example, if one should cut off the tops of turnips and leave them in the field, the lice, and particularly the eggs of lice which infested these plants, would be left there to become the source of continued infestation next year. If cabbage heads be cut out and some of the leaves and roots be left, the enemies which may be on and in these parts left, will be continued. It is far better to pull stumps and all deformed, worthless and diseased plants, and throw them upon a hot brush fire before they wilt. If left until after they wilt some of their insect enemies may escape from them, and remain to infest the next crop; likewise potato vines which may contain the borers which were so destructive in the various parts of this State during the past year. Pumpkin vines, squash vines, etc., which contain the destructive borers, leaves and other unused parts of plants should be destroyed just as soon as possible after the most valuable portion of the crop is gathered. This is not a remedy but a means of prevention, as by this means the pest will not occur in such great numbers another year.

The necessity of the destruction of fallen fruits should be emphasized. In England the most successful orchardists are now keeping sheep and pigs in their orchards to destroy fallen fruits as rapidly as they drop. It is well known that such pests remain for a short time in such fruits. For example, the plum curculio, which stings not only plums, but peaches and apples, remains a short time, only a few days, in the fruits when they fall to the ground. If they be destroyed, the second brood of this pest is prevented. The same is true of the codling moth and various other insects, and is likewise just as true of various kinds of plant diseases. It should be here stated that these various means of preventing insects will, in almost all cases, be those that would be recommended by a botanist as a means of preventing destructive plant diseases.

(5.) Clean farming. By this term we mean that kind of farm practice by which one gets rid of all rubbish about the premises, board piles, brush heaps, leaves, etc., in which various insects, such as the long brown stinking squash bug, asparagus beetles, etc., hibernate or spend the winter. It is a good plan to rake or scrape together all material from the truck-patch and field, and burn it in the fall, after the weather gets so cold that the insects are not likely to leave it, or in the spring before it gets so warm that these pests fly easily. However, care should be observed not to destroy the small snakes

and toads that hibernate in such places. These are so beneficial that one will effect injury to his own interests if he does not watch and preserve them.

By clean farming, we also mean the destruction of all kinds of weeds and all plants that are out of place. Many insects feed on all plants belonging to certain respective botanical families, as, for example, the lice on the roots of the cabbage and cauliflower, feeding also upon mustard. The Harlequin cabbage bug feeds upon mustard as well as upon cabbage and cauliflower. The root lice of these plants also feed upon weeds as well as upon cultivated plants. Thus, it can be seen that if mustard, wild kale, etc., be permitted to grow about the premises, even though the insects be killed on the cultivated plants by cultivation and other means, they will be continued from year to year upon weeds. Some insects feed upon various kinds of weeds they do not have cultivated plants of certain kinds upon which to feed. An example is the Colorado potato beetle can live on the ground cherry. The destruction of weeds not only insures better crops, but also greater freedom from insect pests. The destruction or prevention of volunteer grain and plants that are out of place, also means the destruction of insects which they carry. If wheat be harvested after it becomes dead ripe, for example, and the grains be scattered freely in the field, there is not only loss from the wasted grain, but also growth of volunteer plants in which the Hessian fly and other wheat-destroying insects are almost sure to multiply.

If old or neglected trees be permitted to grow around the premises without care, they support the insects that will constantly menace and attack the desirable fruit trees. It is better to avoid this by destroying all plants and trees that are not needed.

This sub-heading of "clean farming" should include the destruction of dead trees and branches in the orchard, scraping trunks and larger limbs to remove the bark, moss and lichens on trees, and other operations which would prevent the insects from finding protection for pupation and hibernation. The codling moth, for example, passes the winter in the larval stage within silken cocoons beneath the scales of rough bark upon the trunks and larger branches of trees. Not only many insects, but those germs or spores that cause disease of plants, remain during the winter in the moss and lichens on the rough bark, and if each of these encumbrances be removed, the pests and diseases which they protect or harbor are likewise destroyed. The codling moth and other insects pupate during the summer-time also beneath the bark of trees, and their places of pupation should be destroyed in order to prevent their finding safe retreats and expose them more readily to the attacks of their enemies. In dead wood there may often be

found the disease germs and insects that caused the death of the wood, and if the branches be cut and burned at once, the causes of the trouble are destroyed, and future difficulties prevented.

In clean farming, one might also include clean soil, not only free from weeds, but also free from disease germs and insect pests. It is well known, for example, that potato scab, which causes the scabby appearance of potatoes, is a disease due to definite germs or organisms that live in the soil for years. When a field is once badly infested a potato grower should avoid planting upon this again until after he is assured there is no danger of infection.

(6.) Killing pests while they are few in numbers is not only a temporary remedy, but is also a permanent means of preventing their occurrence in disastrous outbreaks. Many persons think that when insects are few they may be neglected without serious consequences. The evils of such negligence often become too plainly emphasized. For example, a grower of pickles came to see us a few years ago, saying that the large stinking squash bugs were destroying his entire crop of many acres for the third time that year. He said that they had been less abundant in previous years, but this was the first season in which they had occurred in such great numbers. He said that he had written to the United States Entomologist at Washington, and had been told that the chief cause of their prevalence during that particular year in that region was the failure of growers to attack and exterminate them while few in number during previous years. All insects are likely to increase until an outbreak occurs as a result of lack of check upon them. Prevent this by destroying all that are obnoxious, letting no guilty bug escape. At the same time one should know which are his friends and not exterminate them.

Many insects may be prevented by planting trap crops for them, as in planting a strip of wheat the last of August in order to receive the eggs of the Hessian fly, and destroying it later. This is a means of preventing the pests from laying their eggs in the regular crop, which is to be planted soon, and for which they might wait a short time. Another example of the trap crop to prevent insects from injuring the desired crop is beans scattered through the field where cucumbers, melons and squash are to be planted in order to attract the flea beetles and serve as preferred food for these pests while the desired plants may be so small as to be seriously injured by them. Yet another example of trap crop is mustard, permitted to grow in the vicinity of cabbage plants, cauliflower, radishes, etc., to catch the lice and root maggots, destroying it as soon as it is found to be infested.

(7.) A variation of the previous method, is sowing a little lettuce among cucumber plants. This has been duly reported to us as

beneficial in driving away the enemies of the latter. Another plant likewise recommended for the same purpose is buckwheat, a few grains of which scattered among cucumber hills have been said to prevent the occurrence of the striped cucumber bugs. (An auditor here said that he had prevented the occurrence of these bugs in his cucumber fields by scattering walnut leaves among the plants.)

II. The second great group of preventatives is to be called *mechanical*. By this we mean any obstruction that will prevent the insect from getting to the plants. The efficiency of mechanical devices depends upon the completeness with which plants are protected, especially while they are young. It is well known that attacks upon young plants are much more serious than upon older ones. Among the mechanical appliances that have been used with satisfactory results, one should mention wire netting put around fruit trees for borers. This should not touch the tree, as there is danger of eggs being laid through the meshes of the wire where it lies directly in contact with the bark. Paper closely wrapped around the tree serves the same purpose, and sticky substances, such as raupenleim and dendrolene, are also highly recommended as a means of protecting the trees from borers. A similar means of protection is a coating of paint made of pure white lead and linseed oil, of the consistency of cream or regular house paint, and applied to the trunks of the trees, down as far as possible, with a paint brush. Professor Alwood, of Virginia, has painted thousands of trees in this way, and reports that all have been protected in a proper manner and none have been injured.

Among the mechanical devices, we should mention barriers to prevent climbing cutworms, canker-worms and other insects from ascending the trees. Bands of loose cotton tied around the trees will be found effective for this. Also, sheets of paper, upon which tar has been spread, fastened firmly around the trees as sticky bands; also, metal troughs filled with oil, even sheets of bright, smooth tin fastened around the trees will prove too slippery to prevent the crawling insects passing over them. Various devices have been patented recently and put upon the market for this purpose, but they are to be recommended for only a few insects, such as canker-worms and climbing cutworms.

If these are to be effective preventives, the time of year they are applied is to be considered. For canker-worms, trees should be banded at this time of year, or about the time the leaves commence to fall, since the females are wingless and climb the trees to deposit their eggs. They do this very late in the fall, or very early in the spring. There are two kinds of canker-worms, one called the fall canker-worm, because it climbs the trees and lays eggs in the fall; and the other the spring canker-worm, because it

leaves the ground to climb the trees and lay eggs in the early spring. Thus trees should be banded both in the fall and spring in regions where canker-worms or measuring worms have been recently known, in order to prevent the pests from occurring next year.

Another mechanical contrivance that is worthy of mention, is a cloth basket for protecting cucumber plants. Make this by sticking the ends of two pliable twigs in the ground in such a way that the cross is at the middle of the arch like the central wickets in a croquet field. Over this double arch put a piece of closely woven mosquito netting or cheese-cloth, and spread earth around the edges to hold it down. The plant will need this protection only while young enough to keep within its limits. It is, perhaps, the best method to keep the plants protected from the striped cucumber bug. If the meshes of the mosquito netting be large enough to permit the entrance of the pest, it may sometimes crowd through, but we have known this to be prevented by dusting the plants with air-slaked lime to which a very little turpentine has been added.

One of the best means of preventing the attacks of the cabbage root maggot is to slit a number of pieces of paper from one side to the center, and put a pad or disk of paper around each plant just after it is set in the ground. When this pad is properly placed around the plant, flies can not and will not lay their eggs at the roots.

III. Chemical Preventives. The use of turpentine and lime and other substances might be called chemical rather than mechanical; but other methods are sometimes advisable, such as using a wash of potash, soap, acids, etc., in order to kill eggs or pupæ and prevent the next brood of insects, or prevent the laying of the eggs. It is especially desirable that in the fall or spring fruit trees should be washed with some such material. A wash of the bark of the trees with potash in water gives a very satisfactory result in preventing both diseases and insects during the coming year. Whitewash applied to the trunks of the trees, as well as to fences, destroys insects and specially prevents their attacks upon trees. A great deal of the value of the lime-sulphur-salt wash for the San José Scale lies not in its killing the adult scale, but in preventing the young insects from finding a fixing place. Lime or dilute Bordeaux mixture is used as a spray upon the leaves of potatoes for flea beetles, not because it is a remedy or kills them, but because it is a preventive or keeps them away. Lime is dusted around the roots of cabbage, onions and radishes, and prevents the flies which produce root maggots from laying their eggs in such places. Sand, with a little kerosene added, is a similar preventive of such pests. Not only for insects, but also for plant diseases are such chemical preventives to be advocated. For example, a mixture of two parts of

lime and one of salt, putting a small handful around each plant, or in the soil as it is set, is recommended as a preventive of club root of cabbage. We have had gratifying reports of formulas published in our "Monthly Bulletin" of the lime and sulphur as a preventive of club root. If we were discussing remedies, we should here mention nitrate of soda from one hundred to three hundred pounds per acre upon fields infested with Hessian fly. The purpose of this is to strengthen the wheat, and thus prevent death to the grain by the attacks of insects, rather than to remedy the trouble by killing the pests.

IV. Fourth and last in the group of preventives, to be discussed, is the general subject of *vital means*. By this we mean every method that will give life, vigor and vitality to the plant. Fertilizer in the soil, strong vigorous plants, good seed, good cultivation, pruning, thinning fruit, moisture, the absence of weeds and other means contribute as vital preventives of insects.

Under this head, however, we wish to emphasize the desirability of recognizing and preserving parasites. While parasitic insects are not of great importance during every year of their existence, they are the chief means by which nature suppresses insect outbreaks immediately following those years when such pests appear in immense numbers. When a diseased, sickly or parasitized insect is seen about the premises let it remain, with the assurance that it will soon die, and the cause of its destruction will multiply and pass to others of its kind. It is to be regretted that definite means for either the propagation or preservation of beneficial insects can not be given.

Under the head of vital preventives, we wish also to emphasize the necessity of knowing the higher enemies of insects, and preserving them at all times. Among these are toads, frogs and salamanders, serpents of all species, land turtles, etc. Also, birds of nearly all kinds that may be found around the orchard or farm. These are natural enemies of insects, and feed while we sleep or work or rest. Let us learn to know them and preserve them in order that Nature's preventives may be effective and man's remedies may not be necessary.

ROUND TABLE—SECTION B.

(Conducted by Prof. Surface.)

DR. FUNK: Regarding what would be remedies and preventives at the same time, I agree with what the speaker has said on this

subject in discussing the lime-sulphur-salt for San José Scale. By applying this material in the early spring you will also destroy the eggs of the tent-caterpillar, the bud moth, etc.

MR. PHILIPS: About this new remedy for San José Scale, caustic potash, it does not seem to have been effective.

PROF. SURFACE: Do not depend on caustic potash. I tried it in January and it has not proven effective. There are reports from many saying that the lime-sulphur-salt solution has been effective. Put it on in the spring or in the fall, or both.

QUESTION: "I understood Prof. Surface to say that painting trees with lead and oil is a preventive."

PROF. SURFACE: It prevents borers from laying their eggs, but pure white lead and linseed oil should be used, and not common paint.

QUESTION: "I was told by a mechanic who had been working on a new house that a man had last year had his house painted with lead and oil. Very near to the house stood a fine pear tree. It was a very vigorous grower and the painter spattered lead and oil on that tree. The owner told him to paint it. In less than a month it died. This man told me of another instance of 100 trees, a certain number of which he painted, and every tree that was painted died."

PROF. SURFACE: Forty thousand trees have been successfully painted with lead and oil, but the fact is emphasized that pure linseed oil and white lead should be used. Doubtless this man used only commercial paint.

PROF. MENGES: Will it prevent a peach tree borer?

PROF. SURFACE: No; because it lays its eggs just at or under the surface of the ground. This remedy is too severe for the peach tree, which is the most easily injured. I should recommend lye, in water, for the borer,—a pint or one-pound can in twenty gallons of hot water. Pour a quart of this around the base of each peach tree.

PROF. MENGES: I have the borer, have done everything I know and cannot get rid of it. It makes little round holes in the bark.

PROF. SURFACE: If you have the pinhole borer, your trees are in a devitalized condition. It does not attack trees in a vigorous condition. Remove the tree and burn it for other causes besides the borer and to keep it from spreading to other trees. It can not

be cured except to have your trees as vigorous as they can be. It attacks only those trees which are already becoming worthless.

MR. DRAKE: Will the same rule for treatment of soil for the cutworm apply for the wireworm?

PROF. SURFACE: This is the hardest insect to treat with either remedies or preventives, but the same method is to be recommended for it. It can be killed by slicing potatoes, poisoning these slices with Paris green, and dropping them on the ground infested with the pests. Keep your live stock away from these potatoes.

QUESTION: "What is the cause of apple trees turning yellow in July and falling off? Remedy for same?"

Answer : It is simply a symptom of a condition. A yellow leaf means an unhealthy condition of the tree, perhaps due to improper nutriment, fungi, blight or insects. It should be seen by an expert or the details should be more fully given.

MR. D. H. WATTS: As an insecticide, what is the chief difference in efficiency between Dalmation and Persian powder?

PROF. SURFACE: I believe Dalmation powder to be very efficient. Persian powder is never good unless fresh.

DR. FUNK: Is it not the root worm that burrows?

PROF. SURFACE: I never knew the green cabbage worm to burrow into the head, but a species of moth larva does so.

MR. RODGERS: Is there a preventive for the green cabbage worm?

PROF. SURFACE: All extensive cabbage growers are using Paris green with success. I should recommend it without hesitation until the heads are three-fourths grown. There are several broods during the year. Kill the early broods and the late broods will not be present. It may be used in a solution of one ounce to ten gallons of water, or as a dust, one part to forty parts of lime.

MR. RODGERS: Will not the Paris green injure stock?

PROF. SURFACE: If the stock get very much it might, but they could hardly get enough, as the Paris green does not stick to the cabbage.

Meeting adjourned.

State College, Pa., 2.30 P. M., Thursday, Oct. 13, 1904.

J. A. Herr, Chairman.

The CHAIRMAN: I am advised by Secretary Martin that the sessions for the afternoon will all be held in this room—both sections. We will first be favored with a piano solo by Miss Helen Atherton of State College.

The CHAIRMAN: Next thing in order is from Section B program, and we will now hear from Mr. Alva Agee on "Potato Culture."

Mr. Agee addressed the Institute as follows:

POTATO CULTURE.

By Mr. Alva Agee, *Wooster, Ohio.*

Mr. Chairman, Ladies and Gentlemen: The first point I want to make on potato culture this afternoon is, that I am very glad to be back in Pennsylvania to meet the institute workers. When I left the State two years ago and attended the institutes of some adjoining states that year, I really had that homesick feeling that comes to a man who has left those he feels he knows best, but the past week away from home has been a week of enjoyment with the old workers and associates from Pennsylvania.

Now, friends, to come directly to the work, in order that these few minutes might be of use to us who go before the farmers desiring to help them to improve their opportunities, I do not propose to take up all the points in potato culture, nor shall I try to present one person's views with the thought that I can teach you men in Pennsylvania, but I shall rather dwell on just a few points —points on which possibly we might disagree in our teaching if we did not confer here together, and all arrive at that form of statement that will give to our teaching, force.

I call your attention to the fact that the Northwestern states are raising too great a proportion of the potatoes of the country. That would not interest us if it were not that potatoes are a profitable crop wherever you can get a fair yield and average prices. It is for us institute workers to try and teach our Eastern farmers to grow all we have a right to grow that can be profitably grown.

The first thing is to put the soil in good physicial condition. We have learned that. We have learned that it can be readily put into condition so that potatoes can be grown with profit. You want that soil fairly loose in order that the potato can properly develop in it, and one that will hold moisture, and when we fill it with vegetable fibre, we have conditions for the control of moisture that enable the potato to make its best growth. I have been taught

not to use stable manure upon the potato ground, but I have ceased to teach that way, chiefly because it is not in accord with practical experience. It is true that stable manure will induce some potato diseases in some soils, but, as a matter of fact, our successful growers, as a rule, are depending quite largely upon stable manure where they do not have a natural potato soil. You have some potato soils in Pennsylvania that need potash and you have a great many more acres that need phosphorus rather than potash.

We are told that fertilizers should be scattered through the ground, over the entire surface, and yet we do not teach that any longer, where it is a potato soil, because the potatoes require the largest amount of soluble plant food. We give the land a little bit of top tillage in order that we may loosen up the soil. We give a little top tillage to it when the potato is appearing from the ground.

I think that the failures right here in Pennsylvania are due to poor seed more than anything else. Now, you can tell whether you have good potato seed or not. You know that the tuber in the ground is going to show its character by the vine above ground. It is only an underground branch, and if you have a spindling vine above, I do not care how much that potato may get under the soil, you don't want it for seed. The potato that has a strong vine above ground will have a good potato for planting beneath, even if it has not reached a greater size than a hen's egg.

I have heard it taught not many years ago, from the view of the botanist, that mature seed is not the best, and yet we have learned there is no seed better than that which is mature. I do not believe that it is our business to advertise machinery of every sort at institutes, and yet I do not hesitate to tell this truth that no automatic potato planter will do perfect work; an automatic corn planter is all right, but with potatoes you have pieces of uneven size and the automatic planter will skip some of the hills and put too much seed in other hills. I want a planter that will require two men to operate, one man making it his business to see that a proper amount of seed goes into every hill.

We make this mistake sometimes in speaking of tillage as a means of retaining moisture, and say that tillage is a means of controlling moisture in the soil, and then if we have a dry season we will till the surface only, and that will retain the moisture. If, on the other hand, we have packing rains, soaking rains, and the ground is water-logged, we can loosen it, we can stir the ground, loosen it up, so that enough moisture in the sub-soil will rise to keep the plants growing.

Occasionally we are asked whether it pays to thin potatoes. Now I believe that notwithstanding the fact that one extensive grower in

Eastern Pennsylvania makes it a rule to thin—I believe we are always safe in saying that it is not feasible—it does not work very well. Experiment station work shows no increase in yield. I have found it very difficult to thin the plants without shaking them up too much.

A word about the controlling of disease. I think that we want to teach men to seek resistant varieties; there is a whole lot in resistance, just as our good friend Dr. Leonard Pearson, who is doing so much for this State in his line, will tell you that certain animals can resist disease better than others, so I say we should have varieties of the humble potato that can resist disease germs; there are varieties which will do this, while other varieties cannot. Let us seek these varieties. Take the early Ohio potato and the early Fortune and you will get a good yield because these varieties have the power of resistance.

As to the matter of blight—early blight, I would rather take a resistant variety of potato and plant it very early and push it than I would to go to the expense of spraying with Bordeaux mixture to prevent the early blight; but if you will only put the mixture on before the germs come and keep the new growth fairly coated, it is profitable.

ROUND TABLE ON POTATO CULTURE.

(In charge of Mr. Agee.)

MR. CLARK: I would like to ask Mr. Agee this question. It is a matter that is agitating the buyer and seller of potatoes. Potatoes are sold in our town by the carload, through Pittsburg commission men. Cars that have been loaded with potatoes in Mr. Agee's country, I do not know whether just his part of the country or not; they come from the northwest and from Michigan. The question is, whether we can take these potatoes out of the cars and place them in the cellar safely?

MR. AGEE: I do not know how to tell with certainty that a potato will grow. I do not know how to tell whether a potato is in good condition to place in the cellar; that seems a damaging admission for one who has made that single thing a specialty of his life, and yet it is so. In some cases you can tell by an examination of the potato that they have not fully ripened; that kind of a potato may heat in the car or the cellar.

MR. CLARK: Do you think that the transfer of these potatoes from the car would be safe?

MR. AGEE: I think the damage has probably been done while

they are in the car. I have shipped a great many potatoes to Pittsburg in hot weather, and when we have to push them upon the market just as rapidly as possible to keep them from rotting on our own hands. You will do well not to store any potatoes for eating until the tuber has so well ripened that there is very little blemish upon it as a result of handling.

MR. HUTCHISON: I would like to inquire if the scab on potatoes don't come from the blight.

MR. AGEE: O, no.

MR. CLARK: I would like to ask what kind of manure you deem it advisable to use. Would you use cow-stable manure?

MR. AGEE: The stable manure is all right for potatoes; some of our good, hard-headed growers are using that every year. We have got to watch their judgment. I can say this, that fresh manure tends to introduce scab; it tends to introduce a little too much nitrogen.

A Member: Does the potato take up its plant food in the condition that it gets it from the soil? Is it possible that that plant food is in just the same condition as it is when it is taken from the soil? That is something that puzzles me to know.

MR. AGEE: Certainly; when you get too deep in there, we are in a field that I know nothing of. I know that the potato is just like a branch above ground. We know this, that the plant will take far more nitrogen out of the soil if it has a good supply there, than it will take if there is a scant supply; I won't say relatively more. It seems, if I got the idea right from Prof. Butz, to require so much longer time to reach the stage when it is ready for reproduction, that we do not get the large tuber that we want.

MR. HUTCHISON: How would you prevent the blight?

MR. AGEE: I have sprayed only for the early blight; the remedy for the late blight is the same. The early blight produces a germ that multiplies when the temperature is up in the nineties. The late blight multiplies when we have a temperature along in the seventies, with a low moisture. In my locality, we don't have the late blight, only about one year out of eight, so we do not pretend to protect ourselves from it, as we do from the early blight. In this part of Pennsylvania you have both the early and the late blight. If growing an early crop for early market, I do not think I could recommend to you that you spray to prevent early blight. You will prevent it somewhat; it might pay you and it might not.

For the late blight, you simply use Bordeaux mixture, composed of four pints of copper sulphate and four pints of lime in fifty gallons of water.

A member asked a question about storing potatoes.

MR. AGEE: We simply bulk them. As a matter of fact, if you want to save your potatoes for the spring market, after they get ripe, you can put them into cellars, thousands of bushels in bulk, and they will do very little sprouting until after the first of March. That is our commercial way of handling our potato crop.

Adjourned until this evening.

State College, Pa., Thursday Evening, October 13, 1904.

Hon. W. H. Brosius, Chairman, called the Institute to order at 7.30.

Mrs. H. A. Surface and Mr. H. E. Saunders entertained the audience with solos, which were much appreciated.

The program for the evening consisted of illustrated lectures, the first of which was given by Mr. Crosby, of Washington, D. C., a synopsis of which is as follows:

NATURE STUDY AND AGRICULTURE IN THE PUBLIC SCHOOL.

BY MR. D. J. CROSBY, *Office of Experiment Station, U. S. Department of Agriculture, Washington, D. C.*

(Mr. Crosby illustrated his lecture by stereopticon slides. Owing to the fact that Mr. Crosby spoke without manuscript, and that the room was so darkened as to prevent our official stenographer from taking notes, only a general outline of the lecture can be given in this connection.)

The speaker began by reviewing very briefly the American system of agricultural education, showing the progress that has been made in recent years toward the development of instruction in agriculture in the secondary and elementary schools. This progress has been

accomplished through the united efforts of officers of the United States Department of Agriculture, the Agricultural Colleges and Experiment Stations, State Superintendents of Public Instruction, county superintendents of schools and others engaged in educational work.

The work in school gardening at the State Normal School at Hyannis, Mass., was described and illustrated for the purpose of showing how such work can be profitably correlated with letter-writing, composition, arithmetic, business training and social training. Similar work in the Normal School at Washington, D. C., with which the United States Department of Agriculture is co-operating, was described for the purpose of showing methods of training teachers for gardening. The young women in the senior and junior classes of the Normal School are required to learn by precept and practice some of the details of propagating and growing plants in the potting room and greenhouses of the Department, and to apply this information in caring for gardens at their homes. These gardens are inspected and photographed by the instructor in charge of this work. The young women also participate in directing school garden work in the grounds of the United States Department of Agriculture, where boys from adjacent schools have vegetable plots, and in the improvement of school grounds in different parts of the city.

Some of the school grounds in Rochester, N. Y., were shown for the purpose of illustrating what children are doing with little or no financial aid for the beautification of school grounds and the adjacent streets. In the vicinity of one school, a mile of shade trees and lawn between the curb and the sidewalk have been planted and cared for by the pupils.

The efforts to introduce agriculture into the elementary schools of the country were briefly reviewed, attention being called to state adoption of text-books in North Carolina, Alabama, Florida and Georgia, and county adoption in Virginia and Maryland. Mention was also made of outline courses in agriculture prepared for the teachers in Illinois, Indiana and Missouri, and of clubs of boys and girls which have been organized in Ohio, Illinois, Iowa and Texas, to conduct simple agricultural experiments.

It was argued that before much can be done toward the successful introduction of nature study and agriculture into the rural schools, teachers must be given better training for this work and the schools themselves must be improved. Considerable attention is now being given to courses for teachers in the agricultural colleges and normal schools of Missouri, Michigan, Massachusetts, Illinois, New York and North Carolina. The improvement of schools could be brought about by increasing their revenues so that teachers could be better paid and retained for a number of years, and by abandoning small

districts and establishing centralized schools with modern school buildings and a number of teachers. In such schools it would be feasible to employ a teacher of science who would be capable of giving instruction in the elements of agriculture.

Whatever else is done, the pupils of the rural schools should be familiar with the publications of their own experiment stations and of the United States Department of Agriculture, so that they may be in a position to secure the information they need regarding any agricultural problem they have to solve.

One of the great drawbacks to progress in the improvement of schools, and the introduction of agricultural teaching in them is the conservatism of the rural people themselves. An effort should be made on the part of the agricultural colleges and other educational institutions, to arouse these people to the necessity of improving the educational facilities of their children in order that a general upward trend may be given to country life.

OUR INSECT FRIENDS.

By Prof. H. A. Surface, *Economic Zoologist, Harrisburg, Pa.*

(This address was illustrated with fifty lantern slides, and, of course, the great value of the lecture consisted in points shown by the illustrations.)

Insects have played an important part in the economy of man, not only in giving wearing apparel and employment to thousands of persons, as does the silk industry, and most valuable food as well as employment, as the bee industry; but minor employments of which we have but little knowledge engage many persons. Among these is the gathering of cochineal, which is a scale insect used for coloring cake, candy, etc., which must not be poisoned.

Among the insects that are used as food for man in different parts of the world are beetles and their grubs, especially by uncivilized and semi-civilized men; fly larvæ, which we have seen dried and powdered, and eaten extensively by the American Indians, especially in the Yosemite Valley, and grasshoppers, or locusts, which are gathered and dried for food by the American Indians, especially during a time of scarcity. It was doubtless the grasshopper, instead of the Cicada, which was used as food and called the locust, as is mentioned in the Scriptures.

Insects are also used for ornamental purposes, as some South American tribes make clothing of the bright wing-covers of certain

beetles. They are used for medicine, as the blister beetle or Spanish fly, from which is obtained the tincture of cantharides. They are also effective in preventing disease, as the dragon fly, which captures and kills mosquitoes, and thus prevents the spread of malaria, which is carried by the latter insects.

Insects produce food directly, as does the honey-bee, and indirectly by fertilizing flowers of various kinds, as do the bees, wasps, flies, butterflies, moths, beetles, etc. They also produce food in an indirect way (2) by becoming the food of fishes, frogs, edible fowls, etc., and especially by fertilizing our fruits.

The chief way in which insects are beneficial is by preventing the loss of the property of men, and this they do mostly by preying upon destructive insects. Among those that are predaceous are the mantis, assassin-bug and many other true bugs (Hemiptera); lacewing fly, ant-lion, various beetles, especially the lady-beetles and ground beetles or caterpillar hunters, robber flies, certain wasps, hornets and others. These insects should be recognized and protected whenever possible because they aid in suppressing the outbreaks of those species that are most injurious. The best way to learn to know them is to see the specimens themselves. Submit material to entomologists for identification and obtain information concerning the same. All questions upon such subjects will be answered cheerfully and freely by the speaker.

Among the most beneficial of insects are those that are called parasitic. The predaceous insects might be called external parasites, while those to which we refer at present are called internal parasites. Among these are various kinds of flies, such as the tachina fly, minute wasp-like insects such as the Braconids, and larger wasp-like insects like the Ichneumon flies. These have been so beneficial at certain times when there were severe outbreaks of injurious insects, that they were almost the sole factors in suppressing such outbreaks. Three years ago, when the stinking squash bug destroyed nearly all the squash, cucumbers and muskmelons in certain parts of this State, we were asked if these pests would be present another year. In attempting to answer this question, we examined many of the bugs in the fall and found, practically, all of them attacked by internal parasites, chiefly the Tachina fly. It is needless to say that the parasites did their work so well that in accordance with our prediction the squash bugs did not appear the next year in destructive numbers, nor even the second year.

It is not infrequent that entomologists, in keeping cocoons of moths or chrysalids of butterflies over winter from which to obtain fine specimens in the spring, find that instead of gorgeously colored Lepidopterous insects emerging from their cages, they have small brown wasp-like insects which have lived as parasites in the speci-

mens which they desired to obtain. These are Ichneumon flies, and the part that these and other internal and external parasites play in Nature is so important that the earth would become uninhabitable for mankind in less than ten years time were it not for their presence. Fortunately, birds, which are also valuable allies of the farmer, do not prey to any great extent upon the beneficial insects.

In this discussion, the insects which are scavengers in removing decaying organic material and other offensive substances should not be ignored. The burrying beetles, rove beetles, tumblebugs and fungus gnats have their important parts to play.

While all farmers and fruit-growers should learn to recognize the beneficial insects, birds, etc., which aid them in suppressing their pests, it is unfortunate that very little can be done from a practical standpoint toward propagating these creatures. This is owing to the nature of their food. Only where it is abundant is it possible to propagate the parasites, and as soon as the food is reduced in amount, the parasites become accordingly reduced in numbers.

The illustrations shown were all made by the speaker, mostly from specimens either in the Museum of the Pennsylvania State College or in the collection which he has made as Economic Zoologist, at Harrisburg.

In conclusion, he said that while this was a subject dealing with small things, it at least would help us to see some of the great results of these in Nature, and we should thus "Call not that mean which a Father's hand hath made."

Court House, Bellefonte, Pa., Friday Morning, Oct. 14, 1904.

Mr. Matthew Rodgers, Chairman.

The CHAIRMAN: The first thing upon the program this morning will be a paper by Prof. Franklin Menges, entitled, "Methods of Cultivating Hay and Leguminous Crops."*

The CHAIRMAN: We find the next subject on the program is "Egg Production," by Mr. J. T. Campbell.

The following paper was then read by Mr. Campbell:

EGG PRODUCTION.

By Mr. J. T. Campbell, *Hartstown, Pa.*

In order to achieve permanent success in any branch of agriculture, the heart, head and hand must be united in the work. No

*The very valuable paper read by Prof. Menges, was not furnished for this bulletin.

branch of agriculture depends more upon the little things for success than does poultry keeping. Three primary factors need to be considered in the profitable production of eggs—breeding, housing, feeding—any one of which, if neglected or slighted, will tend to make the business unprofitable.

The breeding of poultry to increase the egg yield has now reached a point where there is little excuse for wasting time and energy upon mongrels or unlikely breeds. By the expenditure of a few dollars we are able to command stock that has been bred in line for many years, with the principal object of increasing the laying qualities. Then, by continuing to breed within the strain, even the inexperienced amateur may hope for good results and the perplexing problems of breeding will, in a measure, be solved.

Only the lively, hustling, get-up-early, stay-up-late-hen is the really profitable hen. The profit from many a farmer's flock is consumed by a lot of antiquated hens and surplus roosters. The hens should be housed as cheaply as comfort and convenience will permit. Houses built of rough lumber and covered all over with roofing felt are serviceable, comfortable and economical. We are able to erect very satisfactory houses at a cost of forty to fifty cents per hen capacity. We can build them for less than half this sum, if we take our own timber from the woods. We have successfully solved the problem of eliminating the moisture from the buildings in winter by proper construction. Our experience with cotton cloth in place of glass is very favorable to the farmer. Simplicity is the first law of poultry house construction. We have no use for elaborately planned partitions, ventilations, alleyways, etc. We tried these things in our early experience, and they and a lot more orthodox poultry rot, which cost us dearly, were long ago consigned to the junk and garbage heaps.

The questions most often asked the successful poultryman, and perhaps the one hardest to answer satisfactorily to the hearer, are with regard to feeding. Successful feeding for eggs must, to a great degree, be worked out by individual experiment. Local conditions largely control the problem. To my knowledge, there is no best feed or method of feeding definite enough to be adopted without limitation; yet there are certain fairly well-defined principles followed by successful poultrymen generally. Two important factors are digestibility and palatability. Only what a hen consumes, in excess of what is needed to maintain her system, can be converted into eggs. Skill in feeding consists chiefly in inducing the hens to consume large quantities of proper food, without clogging the appetite. Herein is greatest success, but this can be learned only by actual experience. The narrow ration is most profitable. At the West Virginia Experiment Station, in a seven months' feeding

experiment with the Asiatic, American and Mediterranean classes, a pen of Leghorns receiving a ration with nutritive ratio of one to five, gave a profit of $33.88 over a similar pen fed a ration of one to eleven. The cost of producing a dozen eggs with the narrow ration was 5.4 cents, and with the wide ration 10 cents. The average weight of 100 eggs from the narrow ration pen was 12.08 pounds, and from the wide ration 11.94 pounds. Dividing the period of this experiment, the pen receiving the narrow ration gained 51 pounds, while the fowls receiving the wide ration lost 40 pounds, a total of 91 pounds in favor of the narrow ration.

Corn is the most highly digestible of the grain feeds, and is generally the cheapest. Besides, it is exceeding palatable. It, therefore, forms the basis of our ration. The peculiar effect of a corn diet upon the egg yield leads many thoughtless and short-sighted people astray, and even some of the scientific men have been deceived thereby. Milk causes the fowls to consume more feed, hence, has both a direct and an indirect feeding value. This is very well proven by recent experiments at the Indiana Experiment Station, particularly with regard to growing chickens. In our own experience, when the milk was taken away, the egg yield was decreased far out of proportion to the food value of the milk. At prevailing prices, animal or beef meat is one of the cheapest poultry foods, and we find it profitable to feed it quite liberally. It is part of economy and convenience to feed a mash throughout the year. The by-product feeding stuffs are cheaper than whole grains. They also help to get the desired narrow ration. A mash often renders unpalatable foods palatable. The mash is fed in the evening to give the hens increased appetite; to secure exercise of the hens in the morning, and on account of convenience; theoretically, a ration composed of 125 pounds of corn, 100 pounds of corn meal, 50 pounds of animal meal and 50 pounds of alfalfa meal would be a first-class egg ration. It would be highly digestible, palatable and contains food in three forms. Probably, on the average farm, there would be serious objection to such a ration. We have been able to get the greatest profit by feeding a highly concentrated ration, approaching closely the danger line. Not all hens will stand this high feeding, but the loss sustained from the few that succumb is more than made up by the increased egg yield. Feed highly, market the hens at an early age and replace with others.

The teeth of a cow or other farm animal are important factors in determining profit. Sharp grit is the hen's teeth. Hens without sharp grit allow a sufficient portion of their food to pass undigested to greatly reduce the profit. We have little use for condimental and patent foods. While these foods may possess some value, their

cost is many times greater than their real value. We prefer to compound our own feeding stuff and save money thereby.

The loose condition of the bowels, resulting from high feeding, can be corrected by the use of charcoal. Charred corn is ideal. Make it black. This applies with special force in winter feeding.

Whether it pays to feed for winter eggs is a debatable question. While we have had success along this line, we question whether it is, on the whole, profitable or advisable to follow up the work. We find more clear gain at 15 to 18 cents during warmer months than at double these prices during the winter season. Hens forced during the winter will lay less eggs during the warm season.

To produce winter eggs, the hens must have warm quarters and plenty of room. These things, together with the costly feeds and the ceaseless round of labor, tend to make the profit from winter eggs small, especially with large flocks. Recent experiments at some of the stations confirm these opinions. Our present method is to select, at the approach of winter, a few of the more promising birds as winter layers, giving them the best of attention, while the remainder are carried through the cold weather as cheaply as it is consistent with their comfort and health, having them in condition to be forced to their fullest capacity during the warm season. The winter care, if eggs are the object, should approach, as nearly as possible, summer conditions. Much more feed is required to maintain the hens during cold weather, and it is often difficult to induce the hens to consume enough extra feed to produce eggs. Variety is essential. Plenty of animal meal or beef scraps, various by-product feeding stuffs, corn, wheat, oats, especially cooked wheat and oats, green vegetables (table beets are best), warm water or milk, grit for fowls and keepers, some exercise, a lot of "gumption," all used in combination with patient effort, brings eggs in winter. We have conducted some experiments in forcing an early moult, and conclude the practice is unprofitable. While we succeeded in moulting the hens at the time desired, the hens thus treated laid no more eggs than those untreated, and we lost the eggs the treated hens would have laid during August and September. Plenty of oyster shells, where the hens have access to them, insure good shells on the eggs.

Getting the best prices for the eggs produced is another part of the subject.

The CHAIRMAN: The next thing in order on the program is by Mr. R. D. Barclay, on "Bee-Keeping."

The following synopsis was presented:

BEE-KEEPING.

By Mr. R. D. Barclay, *State College, Pa.*

The importance of the bee-keeping industry is little realized. There are in Pennsylvania to-day nearly 29,000 farms reporting bees. There are over 160,000 colonies of bees in the State. The total value of these bees is over $500,000, and the honey produced by them in 1899 was worth $300,000. The average number of pounds of honey produced per colony in Pennsylvania is only 15.6. It is possible, with improved methods of handling, to increase this average to 30; but this increase cannot be made so long as the present ignorance in regard to bees continues. When this average is raised, the value of both bees themselves and their produce will be increased. The value of every colony of bees in this State would then be nearer $5.00 than about $3.00, as it is to-day. The honey produced, because produced in a more attractive form, will be worth much more per pound. The industry is capable of wonderful development, but with the present state of knowledge no improvement can be effected.

Improved methods of operation must replace those at present in vogue. Improved bees must replace those now occupying the hives to be found about the farms. The present black, or German bee, must be supplanted by better races. The Italian bee is the improved bee of this country now. The black bees are ugly to handle, because they will not stay on their combs while these are being examined. They are also much more inclined to sting than the Italian. The Italian bee seems much more able to resist the several diseases which trouble the honey-bee. I have here a small colony of the nicest Italian bees I have seen. These bees came from Mr. E. L. Pratt, of Swarthmore, Delaware county, and you will see that they are very gentle and cling to their comb much better than the common black bee. Mr. Pratt is the most prominent queen breeder in this State. (Showed bees on comb, with queen.)

As most of you are likely aware, there are three different kinds of bees in a hive—the queen, the drones and the workers. The queen is a perfectly developed female and lays all the eggs which

produce the bees. She is capable of laying two kinds of eggs, fertile and unfertile, the first producing workers, or queens, and the second drones. This production of drones from unfertilized eggs is one of the most interesting phases of the economy of the bee. The queen develops from a fertile egg, in a length-wise-shaped cell. The development of her sexual organs is due to special feeding she receives while in the larval state. The drone is the male bee. Queens mate with the drone once for life. The copulation takes place in the air while both insects are on the wing. The drone's reproductive organs remain in the queen and the drone expires immediately after the mating. There are many more drones about than ever mate with queens, and these surplus drones are driven from the hives by the workers when the need for them is no longer felt and when the honey supply begins to decline.

The worker bees are undeveloped females and they attend to all the duties of the hive. For the first sixteen days after they hatch they do inside work exclusively. After that time they become field bees and carry honey, pollen and propolis from the field.

The bee-hives in use to-day are most of them relics of a former generation. Many bees are still in box-hives. If they are in movable comb-hives the pattern has long since ceased to be used by the best bee-keepers. The modern bee-hive allows every comb to be moved about and the relative positions of the combs changed. The manufacturers of bee-keepers' supplies are inclined to devise a great many useless little parts for hives which are always in the road, or lost, and have to be stored when not in use. It is not these I recommend, but simplicity in hive construction and at the same time hives capable of examination without unnecessarily disturbing the bees. Hives should be capable of almost unlimited expansion or contraction. Contraction is allowed by the movable comb and expansion is possible when every hive can be placed above or below any other—with hive bodies which can be tiered up.

Many men to-day try to handle bees without the necessary precaution taken even by the best bee-keepers and then think bees are a bother to handle and do nothing but sting. A good bellows-smoker is a necessity if bees are to be handled with any comfort. Such an instrument consists of a bellows attached to a fire pot. The bellows forces air through the fire pot and blows the smoke out the top. A smoker can be bought for from seventy-five cents to a dollar and is worth it. The hooks which come attached to smokers are very much in the way and hook into one's flesh as often as into anything and had better be left off. The smoker can be held by the bellows between the knees, where it is always ready and convenient when wanted.

The greatest menace to the bee-keeping industry to-day is disease.

Bees are subject to several diseases. The one which is doing its deadly work in this State to-day is foul brood. Perhaps black brood is also here. This is merely a malignant form of foul brood, and is caused by the same germ. Foul brood will be found in many places in this State, where few think it exist, and it is spreading. Its chief manner of dissemination is through the honey. The other diseases of bees are pickled brood and paralysis. Neither of these are very dangerous and their occurrence is local. The first mentioned diseases spread like wild-fire. Black brood, in New York State, has wiped out, within the past few years, a very large percentage of the bees. That state now has competent State Inspectors, and the disease is under control. Wisconsin, Michigan, California and other states are fighting foul brood with state aid. That is what is needed in this State. The methods of combating the disease are well tried and entirely successful. This State must check this disease if bee-keeping is ever to be successful throughout the State. Disease is to bee-keeping what the San José Scale is to horticulture.

To conclude, then, the essentials for the advancement of apiculture in this State are education, improved bees, more convenient and adaptable hives, and, greatest of all, suppression of disease.

ROUND TABLE—SECTION B.

(Conducted by Mr. Barclay.)

A Member: How long after the first swarm does the second swarm come out?

MR. BARCLAY: Eight days, as a general rule.

MR. BIRD: I would like to ask in regard to introducing a new queen into the hive, what course do you take to protect that queen with the hive full of black bees?

MR. BARCLAY: First, be very careful that there are no queens in the hive, then introduce the cage, which consists either of the cage in which the bee was sent through the mail, or a similar cage into which the queen is transferred, preferably removing all attendant bees that have come with the queen in the mail; then, if there is candy at the end of that cage, allow the bees access to the outside of the cage by tearing off the wrappings which you will likely find over them. The bees, in four or five days, will get acquainted with that queen. Or tobacco smoke is recommended; blow it into the hive; blow it right on to the queen and turn her right down between her friends. Be sure the old queen is out of there. You will have no success unless she is.

MR. LIGHTY: I would like to ask Mr. Barclay if the German brown bee is identical with the black bee which he so heartily condemned.

MR. BARCLAY: Yes, the brown German bee is the same thing.

MR. BRODHEAD: I would like to ask Mr. Barclay if there is much foul brood in the State of Pennsylvania?

MR. BARCLAY: I am very much afraid there is.

QUESTION: "Compared with other states, do you think there is?"

MR. BARCLAY: Perhaps not more in percentage, perhaps more than there is in New York State, where they have good legislation.

PROF. SURFACE: I want to say on that point that it is prevalent in many hives and colonies throughout our State, and the keepers do not know of its presence, and they never will know of its presence until experts are sent out, as in New York State. It is for the interest of bee-keepers to have a man sent out over the State to wake up the bee-keepers and to get legislation to help wipe out the disease in our State. If we are going to have honey or fruit we must do this.

MR. BRODHEAD: I will state that I lost sixty-five stacks of bees, and lost them by foul brood.

MR. NELSON: Speaking of the fertilization of the queen, and the time for laying afterwards, don't you find that the fertilization acts much sooner than was stated? It is my experience that young queen bees invariably lay on the tenth day, and that means fertilization on the third day; I have found it so in about 75 per cent. of observations to be the case.

MR. BARCLAY: Did I understand you to say that from the tenth day of their hatching they begin to lay?

MR. NELSON: Yes.

MR. BARCLAY: I have talked about that subject with Mr. Swarthmore, who is a queen-breeder, and is right there to see what is doing every day, and it is his idea that they fly out from the fourth to the sixth day, ordinarily.

The Chairman suggested that as Prof. Menges was obliged to leave soon, it would be desirable to ask him any questions applying to his subject, so that he might have an opportunity to answer them before leaving.

MR. HOWDEN: How can we plough under grass so thick that a mower will not cut it?

PROF. MENGES: I expect that the gentleman I referred to, Mr. I. B. Smith, might answer that better than I can. That is the second crop of grass that he raised on the land that I am talking about, and the turf had not been hardened so much, and the roots were not so long and strong that it could not be easily plowed down. If that turf had been six or seven years old, I think it would have been quite a job, but Mr. Smith succeeded very well in plowing it down.

MR. STOUT: I would like to inquire if the same inoculation you spoke about in your paper that will start alfalfa to grow in a field—do you plow that under with the same bacteria?

PROF. MENGES: Yes.

A Member: Would you sow alfalfa in the spring?

PROF. MENGES: Yes, I would be willing to sow alfalfa in the spring, in the month of May.

A Member: On low ground, where common clover does not thrive, what would you use in the way of seed in starting a permanent meadow?

PROF. MENGES: I did not read that part of my paper; I would advise either to sow the white clover—use the white clover and the alsike clover. I would not use the red clover in a meadow. And, another thing, I would underdrain a meadow of that sort.

QUESTION: "Have you any knowledge of the so-called 'Irish timothy,' and would you advise it as a permanent pasture?"

PROF. MENGES: I do not know it by that name; if there is any one here that can tell me any other name for it, I might be able to tell you something about it.

I have a question here: "What is the price of alfalfa meal and where can it be obtained?" I don't know; that question, I think, is for Mr. Campbell.

QUESTION: "How many seeds per foot square would the one-half bushel of timothy seed give, and would it be policy to have one-fourth of this number of plants?"

PROF. MENGES: I don't know how many seeds that would be; I have that in my paper, but I think I skipped it, I don't remember; but I tell you the trouble with the farmer is

—I am answering this in a general way—we don't sow seed enough; that is the trouble.

I have had a lot of experience along that line; I have seen Mr. Haldeman's grass field, and he sowed thirty pounds of mixed seed; that I gave you this morning, and I tell you now that that land was well-nigh covered with seed, and the grass is so thick on the ground you can't see through it, and that man made four tons of hay this summer from an acre.

Another thing about this matter is, that we do not test our seeds; every seed that the farmer sows ought to be tested; I don't care whether it is corn or oats or rye or what it is, it ought to be tested.

I have this question: "Does not the time that wheat is sown in the fall have much to do with the catch of timothy?"

I will say in answer to that that the trouble is that the wheat takes possession of the ground and the timothy has no other place to grow; and another trouble is it is often covered too thick and can't come up.

MR. HUTCHISON: How does it come that you can raise three tons of hay to the acre under that condition?

PROF. MENGES: We very seldom do it.

MR. HALLOWELL: I want to say that we have never lost a crop of timothy in seeding previous to the first of October, making hay raising one of our staples.

PROF. MENGES: What county?

MR. HALLOWELL: Bucks county.

PROF. MENGES: I come from the eastern part of the State, from the York Valley, and I must say that we have had only about one-third and one-half crops year after year, and whenever the method that I advocated here this morning has been adopted, it has been successful, invariably. I know of a man who has introduced this method of grass raising on a farm, that I regard as one of the poorest, on red shale land. He sowed forty acres to it and last summer when we didn't have very much grass to begin with, that man on that thin soil had a stand of a ton and a half and two tons to the acre. The soil is poor; it is not rich.

MR. HERR: I live within eighteen miles of this place (Mr. Emig's) and I will state that I can't get little enough seed on; the timothy seed is not covered at all. You can go through that field and see any amount of timothy growing there.

QUESTION: "Has not alfalfa been grown successfully for years on river bottom land that is subjected to annual overflow, extending over several days?"

PROF. MENGES: Not successfully.

QUESTION: "Do not horsemen prefer hay from timothy cut late?"

PROF. MENGES: Not if they know their business.

MR. RAYMOND: A friend here indicates that in his practice he found that the cattle did not eat the dry red-top that you indicated as growing, and usually on low-bottom land.

PROF. MENGES: I don't advocate using dry red-top.

MR. SEEDS: There is one thing I would like to ask. If you had a field that you wanted to get into grass for pasture, would you plow it without putting it to rye or wheat or anything else?

PROF. MENGES: I would, yes.

MR. HUTCHISON: In a meadow clearing?

PROF. MENGES: Yes.

QUESTION: "Is it not a fact that the great majority of the best timothy meadows in this country, yielding two tons of hay per acre, are gotten by sowing the seed with wheat or rye?"

PROF. MENGES: Probably that is the case now, but I do not think it is the best way; at any rate, in all the experience that I have had and the observations that I have had, I have found the other way vastly better.

MR. WYCKOFF: Would you recommend the inoculation of soil to be sown with alfalfa by growing soil from a growing alfalfa field?

PROF. MENGES: Yes; I would.

QUESTION: "About how much soil would you recommend to be sown from the already growing alfalfa field?"

PROF. MENGES: That would depend upon the distance I would have to bring it.

QUESTION: "What is the least you think would be advisable?"

PROF. MENGES: Well, I don't know; I would not like to say that a bushel would be enough, but if I were doing it I would do it in this way: I would take, say, a hogshead or barrel of soil and I would soak it in water, and would draw the water off clear and I would soak my seed in the water for the purpose of inoculating

the seed with the bacteria, and then, just as soon as possible, I would spread the seed out on the barn floor and I would get it dry as quickly as I could and sow it at once; that is the way I would do it.

MR. PHILIPS: Personally, I have little knowledge of alfalfa; but it is an important question in the institutes all over the State. Prof. Cooke is not present or I would let him talk. He has been eight years—I think that is the number—as the Director of the Experiment Station in Colorado, where they are exceedingly proud of and familiar with alfalfa culture. All Pennsylvania is trying it. The Professor, in his paper this morning, did not recommend the sowing of alfalfa upon meadow-land or upon any land where water would stand forty-eight hours at any time of the year. Now, wouldn't you rather preach the doctrine as Prof. Cooke does, and say that on no land that is sufficiently well-drained, that water will not stand upon it for ten days at anytime of the year is not adapted to the growing of alfalfa.

PROF. MENGES: I didn't read that part of my paper.

QUESTION: "Will alfalfa grow successfully upon any land high or low, where water will stand within three feet of the top of the ground; in other words, will alfalfa thrive with wet feet?"

PROF. MENGES: No; that is right; that is all right.

QUESTION: "What will you do with the now almost universal plantain in our meadows?"

PROF. MENGES: If you have enough grass there the plantain will not get there—you keep the grass there and the plantain will not grow.

MR. HOWDEN: That is one thing I can't agree upon. I have got a meadow just as thick as it can be, and the plantain is coming in.

PROF. MENGES: I referred to a meadow this morning with which I am acquainted ever since I know anything, and I know there is only one spot in that meadow where plantain grows, and that is a little place right along the road that is very seldom plowed. I haven't see any other place.

MR. McHENRY: If that will eradicate the plantain, why do they have it growing up there on the college ground? I saw the seeds growing that length (indicating) yesterday.

PROF. MENGES: I don't know; you had better ask the college men why they have it growing.

MR. McHENRY: Would it be in order to make a motion in regard to our afternoon meeting at this time? If it is in order, I will move that we meet at half-past one instead of half-past two.

Motion was seconded and agreed to.

ROUND TABLE—SECTION A.

(Conducted by Mr. Campbell.)

MR. SCHWARZ: I want to ask Mr. Campbell whether beets are to be fed raw or cooked, or how?

MR. CAMPBELL: Feed them raw. Cut them in two, with a hatchet, and stick them against the side of the wall; the hens will do the rest.

QUESTION: "What is the price of alfalfa meal and where can it be obtained?"

MR. CAMPBELL: That is a new food product. I know of no place at this time this side of Chicago where it can be obtained. No doubt, before spring, all the wholesale feed stores in the cities will be handling it. What I have came from Omaha, Neb., but the excessive freight charges are against getting it there. In carloads, it will cost about seventy cents per hundred pounds; in hundred-pound lots, one dollar per hundred pounds. As soon as we can get it from the wholesale feed stores—nearby stores—why, we can afford to feed it. It is made from alfalfa, grown by irrigation, and lots of it is just as fine as flour. It analyzed from 23 to 24 per cent. of digestible protein at the Nebraska Experiment Station. The manufacturers of this meal guarantee it to contain 14 per cent. of digestible protein.

MR. WALLACE: I would like to ask whether a warm mash fed in the morning is better than a mash fed at night?

MR. CAMPBELL: I want to feed the mash in the evening, because the hens digest it more quickly and come off the nest in the morning with a better appetite.

MR. SCHWARZ: I would like to ask whether that price for alfalfa meal is not excessive, and, if so, why is not our home-grown clover seed chopped up just as good?

MR. CAMPBELL: Because it has not got the feeding value and we cannot manipulate it in the mash as we can this material.

PROF. WATTS: A few years ago I conducted an egg test, one upon a single-comb Brown Leghorn and another upon a single-comb White Leghorn. The single-comb Brown Leghorn so far excelled the White Leghorn in laying that I have since disposed of all my White Leghorns. I would like to ask what is known concerning the variability of different strains of the same breed?

MR. CAMPBELL: That is a big question. It would take the whole half-hour to discuss that question. We cannot, as farmers—and I am treating this from a farmer's standpoint—we cannot undertake to determine this. The only thing a man can do to-day is to study and profit by what the other fellows have already done. We have strains—single strains of White Leghorns bred in a continuous line for thirty years. It is just like breeding for the dairy cow. We must start right in where the other fellow is leaving them or where he is, and then continue to breed this old strain. As soon as you begin crossing strains you get left. Stay within the strain; when you get a laying strain, stay within that strain. A stock-breeder will know what I mean by that.

MR. HOOVER: Isn't it a fact that hens, as a rule, are a good deal more productive by using warm food during the winter, and a good proportion of that food, animal fats? Is it not quite a help to them to produce eggs?

MR. CAMPBELL: Yes, it is. I want to say first, that perhaps I did not answer Prof. Watt's question satisfactorily. There is no reason why the Brown Leghorn should not be as good as the White Leghorn, but she is not; the reason is, she has not been bred to that fine point of egg-laying.

There is a man down here at Leona who holds the world's record on pure Plymouth Rocks. I can't give his name now, but I can find it. He has got that by years of breeding within that strain and keeping what he wants in view all the time.

A Member: What do you regard as the cheapest and most satisfactory feed?

MR. CAMPBELL: The animal meal is the cheapest feed to-day that is on the market, when we take the digestible nutriment that it contains into consideration. If you will refer to Bulletins Nos. 81 to 85 from the Experiment Station at Morgantown, West Virginia, you will find some valuable information on this point.

MR. BARCLAY: The first question is, "Do you advise clipping the queen?"

The way to answer that is, that it depends upon what you want to clip her for. If you expect to be present soon after the swarn returns, which is the result when the queen is clipped, I believe clipping is the best thing; but if you want to hive your swarms and do not want to have them come back, do not clip.

The next question is, "Whether a drone hatched from a fertile worker egg is capable of fertilizing the queen?"

Well, that question is asked from a misunderstanding, I think. A drone hatches from an unfertilized egg, from which all drones must come, whether the egg is laid by a virgin queen or a fertile queen, or a worker, which I have not discussed, that drone is considered to be as capable of fertilizing a queen as any other drone.

QUESTION: "Isn't it a fact that the workers put the egg into the queen's cell cup?"

MR. BARCLAY: I think not. It may be in some cases, but, as a rule, in what are known as free constructed cells, cups made for forming the superstructure, the queen lays directly in the cell cup.

QUESTION: "Can keepers or any one actually see the queen lay in the queen's cell?"

MR. BARCLAY: I think so.

QUESTION: "Where do the bees collect wax?"

MR. BARCLAY: Bees do not collect wax; wax is a product pure and simple of the honey-bee. The wax is secreted in glands on the inside of the abdomen of the worker and comes out between the scales of the abdomen as little light scales. The bees, when they are making wax, consume a quantity of honey that is lying in along —clinging together by the feet, and in that way the wax in a few hours will begin to ooze out, as it were, between the scales of the abdomen and then is removed by the feet and manipulated by the mandibles of the bee.

PROF. SURFACE: How many pounds of honey to one pound of wax?

MR. BARCLAY: It seems that bees during certain conditions can manufacture wax much cheaper than at other times. By experi-

ment, we can't say any more definitely than from ten to twenty pounds; ten to seventeen, perhaps, we had better say.

PROF. SURFACE: Of honey to one pound of wax?

MR. BARCLAY: Yes; the comb often has other uses besides the use of wax.

A Member: How are the women to use the smoker according to Barclay's patent method?

MR. BARCLAY: I hardly know how to answer that question unless they wear bloomers; they might have a hook in front of the dress; I don't know whether that would be practicable.

QUESTION: "Would a loose sting give any venom?"

MR. BARCLAY: That depends very much on how old the sting is. The sting will, in time, dry up, so as to have no reflex nervous action in it; within a few hours it would probably sting.

QUESTION: "Does the bee-keeper become immune to the effects of stings?"

MR. BARCLAY: He becomes immune to the extent that there is no swelling for a few moments after the sting is received, but at the time the sting is received it hurts just as much, whether you have been stung for forty years as it does the first time, but the after-effects are not so severe.

QUESTION: "Can you give us any information about bee-stings as a cure for rheumatism?"

MR. BARCLAY: I never had rheumatism, but I had some testimony on that point only last Friday from a man who has been keeping bees for a long time who has been troubled with rheumatism. In his experience, bee-stings have not seemed to increase or to diminish the rheumatism any.

QUESTION: "In what manner do you ascertain how the bees lay six eggs per minute?"

MR. BARCLAY: Prof. Foltz says he has watched them lay at that rate for hours.

QUESTION: "How many eggs will one queen lay, and how is this known?"

MR. BARCLAY: As I have said, they will greatly increase from about the 15th of February on an average until, say, the 20th of

June, then greatly decrease until about the 1st of October and that would probably make our average considerably less than 500 eggs per day during that period, and it would vary, of course, with the length of her life. I am not enough of a mathematician to calculate that off-hand, but it can very easily be done.

QUESTION: "How could you change bees from the black to the Italian?"

MR. BARCLAY: By removing the black queen and the introduction of the Italian queen. I hardly have time to discuss the matter of the introduction of the Italian queen.

QUESTION: "Is the queen able to law drone eggs or worker eggs at will?"

MR. BARCLAY: That is somewhat of a disputed question; it would seem funny if I answer that she is able to control the fertilization which results in controlling the sex of the egg or the progeny. Higher organized animals are not able to do it, but I think that it is generally accepted that the queen can control the fertilization of the egg which in time controls the sex. The queen will lay drone eggs in worker cells if she has no drone cells in which to lay them.

Adjourned to 1.30 o'clock P. M.

Bellefonte, Pa., Friday, 1.30 P. M., October 14, 1904.

The session was called to order by Deputy Secretary Martin, who announced that Mr. Clark, not being well, Mr. Billings, of Erie, would act as Chairman.

The CHAIRMAN: Gentlemen, a great many of us are certainly interested in the session this afternoon. The first topic on the program which we will take up is, "The County Chairman." This discussion to be opened by the Hon. Jason Sexton.

MR. SEXTON: Mr. Chairman and members of the Farmers' Institutes from the different counties and the county chairmen and managers of Farmers' Institutes, who our Deputy Secretary and Director of Institutes holds largely responsible for the success or failure of the institutes of the several counties, I am certain we shall be ready and willing to admit that without the right man in the right place managing the institutes in the separate counties, his work would be very much curtailed and even the Department

of Agriculture could do but very little. We are all liable to make mistakes; it would be strange if we did not.

This subject of the management of institutes in the separate counties, in my opinion, ought to have been brought up when we had the greatest number of chairmen present; but as it was not taken up, and we have been continuing these sessions for several days already, we can't blame our people if they wanted to get off home, and I am going to make a very short matter of this, and then we will listen to the discussions of others afterwards. I supposed that, probably, the Director would want to publish what we had to say on these lines, and so I wrote out a few thoughts.

Mr. Sexton then read the following paper:

THE COUNTY CHAIRMAN.

By Hon Jason Sexton, *North Wales, Pa.*

That the success of our farmers' institutes depends largely upon the work done and interest taken by the county chairmen, is admitted by all institute workers, as well as by the farmers and general public who attend. The Department of Agriculture and the Director of Farmers' Institutes may do all in their power to aid us in the separate counties by sending us competent lecturers and practical farmers to teach our people and give instruction in our separate lines of work on the farm (and no State sends out to its Farmers' Institutes a more practical and better equipped set of men), yet I am convinced that their usefulness is often curtailed and the practical results at many institutes falls far short of what they should and would be, if the chairman of the board of managers was always the right man in the right place. I know these men who come to us as teachers are not slow to observe, as they reach the localities where the institntes are to be held, whether the men who have the institutes in charge, and are largely responsible for their success have taken the interest they should and prepared the way, not only to properly receive the speakers sent by the Director, but whether the farmers, large and small, with their families, have had notice of these meetings and been invited and

urged to be present, ask questions and take part in the discussions, thus getting the whole neighborhood interested—men, women and children, and in this way bring them under the droppings of some agricultural knowledge, and new ideas that will set them thinking as they return to the farm.

As there are others to follow me on the question of local management, I will make this paper short. As I do so, you will pardon me as I make some personal allusions to my own experiences during the past twelve years in overseeing the work of the institutes in my county, which have ranked—if not first—among the first, as the records of the Department will show, in interest and attendance of any county in the State. For some years the work was left entirely for the member of the Board of Agriculture representing the county, with such help as he could enlist among the more progressive farmers of the localities where the institutes were to be held. But few, indeed, were the farmers in those early days of our institutes, even among our best farmers, that believed any good would come out of this new movement to teach "book farming," as they seemed pleased to call the efforts that were being put forth by the Board of Agriculture to better the condition of the farming classes.

Many good farmers stood aloof and turned a cold shoulder to every effort we were making to better the condition of the tillers of the soil; and if they attended our meetings at all, it seemed to be more for the purpose of criticising what was said and done rather than admit that there was anything for them to learn from discussions of the simple questions pertaining to the farm and farm life. But, thanks to persistent efforts of the old Board of Agriculture, and the now very efficient Department of Agriculture, those days and years have gone into history, and the men who then looked upon our work with suspicion and some contempt, fearing we might lead their sons astray into the wilds and mists of "book farming," are now, not only better farmers, but our most earnest supporters of the institutes, and each locality is vieing with the other as to which shall get the next one. Our experience during these years has taught us that the county chairman is an important factor in the line of making the institute a success or failure. But, thanks to the wisdom of the Department, he is no longer alone responsible for its success, but has associated with him a representative of each agricultural organization in the county, whose help he very much needs. But even they depend largely upon the chairman to attend to the details, and expect him to appoint committees, help make out the programs, look after the payment of bills, entertain the State speakers and local help, the securing and arrangement of the hall, and dozens of other matters that will need looking after weeks and months before the time of holding the institutes. The newspaper

men must be seen and secure their good will, and get a local notice, if possible, without paying the price of an "ad." He must lay out plenty of work for his workers and then see that they do it, and if they do not, he must spare time to do it himself. He must, like the great Napoleon, have marshals that can plan and lieutenants that can execute. He must see to it that the hall or place of meeting is in such condition that the audience can be comfortably seated. He must see that the speakers are provided with good hotel accommodations or good quarters, where proper hotels can not be had, as is the case in some localities. He should see to it, after the speakers have been notified, how they can reach the nearest railroad station where the institute is to be held, that good teams are there to meet them, and that on time, so they can reach the institute early, that the chairman may have a little time for consultation, which sometimes is important, and it will also give time to introduce them to his committee and as many farmers as possible, who are always glad to meet them. The chairman of the board should always be a fit man to preside at his institutes, and should have his coworkers close at hand to advise with at anytime. However, should he feel that he is not competent to preside, he should appoint some one he knows is a competent person to fill the position, for many of us know that much of the success of an institute depends upon the presiding officer; an incompetent presiding officer will never get the best work done or the greatest good out of any institute—whoever he may be, he should study, in advance, the duties of a presiding officer. He should be a fairly good parliamentarian, and see to it that the business of the institute is conducted in order and with dispatch, never allow business to lag or be run on slip-shod methods, as is sometimes done. I have often thought it would be well to have the old adage, in large letters, hung over the platform of every farmers' institute, where all could read, that "order is heaven's first law." The chairman should adhere to the program as nearly as possible, announcing the subjects and introduce the speakers in a few well-chosen words, especially if they come among us as strangers. He should time each speaker according to the length of the program, and have the courage to call him down, even though he be a State speaker, who insists on giving a lecture or read a paper from an hour to an hour and a quarter long. He should see to it that not a moment goes to waste—always having something on hand to entertain and interest the audience, and to use up every spare moment. But, should there be a lull, or the audience become restless, he should be ready at once to entertain them with some music, or a short recitation, such as the young people are always ready and pleased to give us. We should make

this their opportunity, which they are always glad to improve, thus largely adding to the interest of the institute. No wise board of managers will ignore or neglect our young people, when they make up the programs, but will see to it from the start that they have plenty given them to do in the way of committee work, such as selecting and preparing the music and recitations, and giving them the usher work to look after, which is very important when the halls are crowded. We should be sure and make the young people feel at home and have them understand that we need them.

You will pardon me if I go back to what I believe should be the preparatory work, in order that our institutes be made to accomplish the most good, and reach the greatest number of our farmers and their families—for every county chairman knows that no institute will be a success if the farmers in the locality are not interested and willing to work to accomplish that end, for where no thought or preparation is given for weeks in advance, in nine cases out of ten such institute will prove a failure. I have found, as a rule, the farmers in the locality where they are wanting an institute held, are ready to help make it a success if they are given to understand what is required of them, and that their institute will not run itself. Hence, the county chairman should call them together, at least six weeks before the date of the institute, and explain to them what it will be and what will be expected of them, and awaken their local pride by telling them of the success of institutes in other places, thus putting them on their mettle, so that, after the first or second session, the largest hall in town would be too small—we want to impress upon them that the responsibility of the institutes rests entirely with them. Their efforts have generally brought out the best people in the community, and few, indeed, are the farmers in these days who feel themselves too wise to attend our institutes. At these meetings, I suggest they get the ladies interested and secure of them the loan of as many house-plants as possible to decorate the hall and platform. I also urge the farmers to bring as much as possible of their products for exhibition—all these add much to the interest of the meeting, and always at the close a petition is presented asking for another institute.

The chairman should also be wise enough to adapt himself to the peculiarities of the people in the different localities where institutes are held. In most counties the make-up of the people in some sections is entirely different from other sections. For instance, in one part of my county is a community of Quakers, in another is a large settlement of Schrenkfelders, in another a large German settlement, where the farmers and their families still talk the Pennsylvania Dutch; they are industrious and among our best farmers. Several years ago they asked for an institute in their part

of the county—of course they were entitled to one. I was loath to go there, for I could hardly speak a word of German, and could understand but little of it; there was among them not over a dozen farmers that knew what an institute was like, or what it ought to be. At our first meeting I could see no way out, only to give them a session or two, where they could discuss such questions as they chose in their native Dutch, and I provided speakers for them who were competent to handle their subjects in their native tongue. The plan took well, and from that time on we have had no more earnest supporters of our institute work than these Pennsylvania Dutch. Several institutes have since been held there. I have sometimes thought it would be wisdom on the part of some of our State speakers if they would take a few lessons in the school of adaptation, as their teaching, I am sure, in certain localities would be much more appreciated if they could get down in close touch with the people. I have attended institutes, and so have many others, where, seemingly, no preparation whatever had been made, where the speakers, when landed at the nearest station, found no one to meet them, in fact could find no one that knew anything about it. After securing a conveyance to carry them two or four miles, they finally found a cold hall, where the chairman was just building a fire, and not more than a dozen farmers on hand with the time for opening already past and seats all covered with dust, not fit for men with decent clothes, to say nothing about the ladies. Now, the chairman was a good, clever soul—but not an up-to-date institute worker; but such cases we are glad to know are very rare. That such institutes are not profitable, either to the community or Department, goes without saying, and neither the chairman or community have any claim to expect great results. I apprehend that it is to remedy some of these defects and better some of the existing conditions that the Director has brought this subject to our notice, and this matter up for discussion, thus hoping to aid each county chairman to do his best in preparing for and conducting our institutes, that our farmers and their families, in fact all who attend, may get the greatest possible good out of them. The benefits already derived by the farmers of the State from these institutes are beyond computation; yet there is great room for improvement if all interested do their full duty.

One other suggestion, and I will bring this rambling talk to a close. It is this: The county chairman should make it a point to always be in close touch with the Department of Agriculture—especially with the Director of Institutes, who is ever ready to aid us in all matters pertaining to the institute work, and is only too glad

to do so. And he also has a right to expect every county chairman to co-operate with him as he endeavors to give us the very best in his power.

The CHAIRMAN: Our next topic is "Institute Committees." This topic is to be taken up by H. W. Northup, of Lackawanna County.

MR. NORTHUP: Mr. Chairman, Ladies and Gentlemen: We are here this afternoon in this quiet place and we have come together to discharge our duty. Now I want to say to you that I am sometimes troubled with the gift of continuance, but I will not do that this afternoon; it is not an uncommon thing for the Chairman to have to rap me down.

I like to see the people and see the farmers; I like to see their families in the farmers' institutes. I would like to talk to you without a paper. I never could do anything with a paper and sometimes I have wished that what I have said did not get on to the record. However, I am going to read this paper as I have got it here, and if I just drop off now and then a minute and interline something, you will excuse me.

Mr. Northup then read the following paper:

THE ORGANIZING OF INSTITUTE COMMITTEES—THEIR WORK AND IMPORTANCE.

By Mr. H. W. Northup, *Glenburn, Pa.*

The farmers' institute of to-day is a progressive measure in agriculture. They have become extensive in their work, and their numbers have largely multiplied. The agricultural report of 1903, shows very clearly that they are held in nearly every part of the United States. Out of the 52 States and Territories, there are only three states and three territories in which they are not held. The attendance has increased during the past year, over that of the previous year, 820,000. The interest manifested in the farmers institutes is seen in the action of the legislatures of the several states, and of the officers having control of the work, in making appropriations for their support. They vary from $35 dollars in the Territory of Hawaii, to $20,000 dollars in the State of New York. Pennsylvania, our home state, held last year 327 farmers' institutes; and these institutes had 831 sessions constituting the regular arrangement. Beside these, about 75 independent institutes were held by farmers' clubs, granges and county agricultural societies.

This is simply a bird's-eye view of the enormity of the work. We shall now consider some of the methods for carrying on or conducting these educational gatherings that are so helpful to the average farmer. In the little county of Lackawanna, the youngest in the sisterhood, and in fact not considered an agricultural county, we are holding 12 days of farmers' institutes every year, and there is a demand to-day for more of them at other places in the county. I suppose the reason of this is because we are located among the hills and mountains in a rough part of the State. But a better reason is, that we are near one of the richest anthracite coal fields in the world; and have an excellent market. It pays to farm intelligently anywhere, but especially so, when circumstantial advantages are all in one's favor. We are running the business for the dollar that is in it, and with us, "knowledge is power." Ours are all two-day institutes. They work the best; give the best results, and proportionately cost the least money. We aim to make the first day equally as attractive in all the exercises, the information quite as practical, and secure a class of speakers who compare favorably with those who are to follow. In this way of doing, we get a full house the first day, and especially the very first evening. It requires some work on the part of the chairman and his associates, but that which costs nothing is usually considered worth nothing.

It is the next thing to an impossibility for the chairman to do all this work alone. He must have some good, well-tried and trustworthy helpers that are fully interested. in order to make it a complete success. These constitute his committees for executive work. They should be located right on the field, and some of them right near the place where the institute is to be held. They should all be well organized; for it becomes necessary for the chairman to meet them a number of times before the institute exercises take place, for special consultation. It is through these committees that the chairman ascertains just what the farmers in each locality mostly want. Where the papers and recitations are to come from, and the character of them; also just how many are needed. Where and how the hall or church will be secured, warmed and lighted, at the proper time. To know whether or not a local choir can be secured to furnish all or part of the music. To know if the church pastor will be expected to be present to open the service and give prestige and dignity to the occasion. To know where teams and drivers will be secured to carry speakers and others at the exact time and place; also to know where and when entertainment will be furnished for these. It is largely through these committeemen that the institute will be advertised. The large handbills will be placed in the different postoffices and most conspicuous places by these helpers. Fifty printed programs are sent out to a commit-

teeman in each locality where the institute is to be held, and they are sent out by mail to different farmer friends, especially inviting them to attend all the sessions. These programs are made up by the chairman under the eye and dictation of the local committeeman where the institute is to be held, some time previous, so that the committeeman is a partner in the concern. These helpers are also the question committee. They assist the chairman in soliciting and reading the questions, so that the question-box is constantly replenished.

We sometimes use our committee, previous to holding the institute, by having them solicit exhibits from their farm neighbors of fine samples of fruit, flowers, vegetables and grain. At the time the institute is held, these are displayed on tables and labeled, showing the variety and the name of the producer who furnished them. This becomes a very interesting part when the farmers assemble, to see who can furnish the best and most attractive display. This leads to a great many comments and furnishes one of the best places for farmers and their wives to visit that can be found in the church or hall. I say in the church, because all of our institutes are held in churches. Our people think the better the place, the better the deed. The churches are willingly offered to us, because we pay five dollars for the use of them for two days and this helps to pay the sexton for his services and makes a very comfortable place for the people to meet. Its a very convenient place for refreshments, for the Ladies' Aid Society serve meals in the basement or church parlors, and it is helpful to them in their good work.

In our county, we have only farms enough to entitle us to four days of appropriation from the State, so we must be in readiness to bear the expense of the other eight days ourselves. We must raise at least $100.00 dollars by voluntary contributions in order to secure $100.00 more from the commissioners in our county, in accordance with the act of the Legislature of March 28, 1851. By so doing we have a membership fee of fifty cents for farmers and twenty-five cents for their wives and daughters each year, and when this is paid, they are entitled to membership in our order and have special privileges granted to them. We experience very little difficulty in raising this amount. Our committeemen act as solicitors, and in a very few minutes the full quota of the institute in session will be provided for. At the close of our institutes, or when they have all been held, we have a day appointed at the court house, when all the officers of our society and the committee from each institute meet together to present bills and settle accounts. We have always had money enough and we never fell short.

In order that we may do a little something as an appreciation of the faithful services of our committeemen, we send three of them

each year as our delegates to State College, at the commencement exercises, and pay their car fare. They seem pleased to go, and this makes a nice little outing. The importance of their work as committeemen cannot be estimated. They are always helpful to the chairman and his assistant. With the exception of our first and last days of the twelve, we are usually holding two institutes each day. This makes an abundance of work, and only for the assistance of these helpers we never could make things harmonize and succeed. This is carrying on the farmers' institute on business principles, and it works all right. It is said of a certain general, in the fierceness of a struggle, when the battle was raging, he took in the situation with his field-glass and saw that his troops were retreating. He stood erect in his saddle, and shouted at the top of his voice: "The eye of your commander is upon you; he expects you to conquer or die." His subordinate passed those words down the lines, and sudden defeat was turned into a grand victory. The same is true with the active institute chairman. In the time of emergency his committeemen gather around him and bring sure success and victory out of defeat. They are not to be dispensed with in their valuable services in carrying forward this institute work. They stimulate an interest in speaking to their neighboring farmers about improved methods of conducting farm work, and inspire them with an interest to be present at the yearly gathering when the farmers' institute is to be held. They tell them about the different speakers that are coming, and that they do not want to miss the opportunity of hearing them. All these things work together for good and are helpful to the agricultural interests of the county. When the farmers' institute is held at a place where there is no public house to entertain the speakers and other strangers, then they come up heartily and meet the emergency by inviting these to partake of the hospitality of their own farm homes. It is often a very elaborate entertainment, too, for the farmer of to-day dwells in comfortable quarters, and he is prepared to make others comfortable. In this institute work the committeeman himself is more largely benefited than any other farmer, from the fact that he is doubly interested. He spends more time in investigation and study which tends to make him an apt scholar when opportunity favors. In our county, we had a progressive farmer who was a dairyman, but he had limited advantages in seeking an education. He came to the farmers' institute and afterward was made a committeeman. He heard Prof. Watson, of State College, speak at Moscow on, "The Selection of a Dairy and the Feeding of a Balanced Ration." He became doubly interested and immediately sent to the College and got a bulletin on cattle feeds. This he studied by lamplight many times until the midnight hour. To-day he can formulate

a balanced ration almost equal to a professional dairyman, and he owns the finest herd of Ayershire cows in Lackawanna county. It pays to be a committeeman in a farmers' institute when there is a desire for agricultural information and application made on the part of the farmer to receive it.

In order to have successful institutes, the committee should have full confidence in the executive ability of their chairman, and the co-operation mutual. One cannot succeed well without the help of the other. It is far better for the chairman to resign his position as soon as circumstances will permit, when he discovers that there is an element of antagonism working against him in the institute committee, rather than to persist in holding his position to the detriment of the work. In our agricultural society, the chairman does not always appoint his committeeman. In accordance with our by-laws he is elected each year by the local institute, to represent their interests in the regular meeting. But in that meeting the chairman can appoint others to assist when it meets with their approval. Our committees, however, have always worked in harmony with the chairman, and our institutes have been for years a satisfactory success. For all of this, much is due to the able and satisfactory management of the Director of Institutes, Hon. A. L. Martin, who has sent to us an excellent class of lecturers, and furnished a sufficient amount of advertising material, for which we are all very thankful. The ordinary farmer is many times greatly helped by his attendance at the institute. Mr. George T. Powell, of the State of New York, was at one time the Director of Farmers' Institutes. He relates the following circumstances: At a certain place, the institute meeting was to be held, and it was a fearful rainy day. Only two persons beside himself came out. He walked up and down the platform for some time, questioning, in his own mind, just what would be best to do. He decided, however, that he had better go down and speak to these two men. He did so, and asked them how far they came. One had walked seven miles in the rain, and the other not quite so far. He then decided that if farmers would come that far in the rain, he would go on with the institute alone. His first topic on the program was a talk on the silo. He gave it as faithfully as he would to a full house. At the close, one of these farmers came up to Mr. Powell and said: "Would you advise me to build a silo under discouraging circumstances. I have a farm, but it is mortgaged for more than it is worth, and I am about discouraged." Mr. Powell told him that he could build a silo on the inside of his barn for $40. If he could spare a cow and sell her for $40, that would be money enough to built it. A number of years afterward, Mr. Powell came into that neighborhood and he enquired about this farmer. He was told that the man had built

a silo. He had the mortgage all paid off, and had money in the bank. This was all brought about by his attending the farmers' institute that rainy day. The benefits derived from farmers' institutes are seen in every locality. The farmer of to-day is living in the most progressive age the world has ever known, and if he is not better prepared to meet the requirements of his business than his fathers were it is simply his own fault. The opportunities for receiving agricultural instruction, as provided for by the farmers' institute, is comparatively at his own door. The progressive farmer is gathering up this useful information and applying it to his own farm, and to his own home.

The CHAIRMAN: Our next topic and the last on our program for this afternoon is, "Advertisement of Institutes." This topic will be taken up by Mr. George A. Woodside, of Warren county.

The address of Mr. Woodside is as follows:

ADVERTISEMENT OF INSTITUTES.

By Mr. George A. Woodside, *Sugargrove, Pa.*

Mr. Chairman, Ladies and Gentlemen: I realize that I am probably the youngest chairman here to address you, and I feel wholly incompetent to do it, especially as the two preceding speakers have stolen a good deal of my thunder.

In the advertising of institutes—I would have changed the subject a little—I would have said "My way of advertising institutes," for it is my way of which I shall speak. I will speak of the June meeting of the Board of Institute Managers. About two weeks before that meeting I got twenty-five postal cards, took them to the printing office and had this printed upon them: "Farmers' Institute of Warren County. Farmers' institute managers will meet in the grand jury room at Warren, Pa., on Tuesday, June 14, at 1 o'clock P. M., for the purpose of selecting places of holding the two farmers' institutes during the coming winter. Any party or grange wishing an institute in his locality, should be present and come with a statement of what his locality will be willing to do towards making the institute a success."

Now, we have nineteen granges in our county, and we do our insti-

tute work very largely through the grange. I sent one of those cards to each one of our granges.

We have always had more applications for institutes than we have been able to supply. This year we had, I think, five or six applications from that many granges for that many institutes. Of course, we could only grant two of those requests. Now, what has this to do with advertising? It gets it before the whole county and every grange in the county, and I have found it a good way to advertise through the grange; these cards are read in every grange meeting and that advertises the institutes all over the county. Previous to the organization of the present Department of Agriculture, we never had a farmers' institute outside of Warren. Very few farmers ever attended those meetings; I know I never went there. They were not advertised. Nobody knew of them, but since the organization of the Department of Agriculture, and Mr. R. J. Weld being the first party to take up the work, we have never held a meeting in Warren, but they have always been held outside, in the smaller towns; and out in the country there have been six or seven. We get them out in that way all over the county. In the places that get the institute the member or the person that comes down there and asks for it gives me a report of their success or failure, as the case may be. Whenever they are successful in getting one, of course it is advertised in their grange. All summer they are preparing for the work, talking about the institute for the coming winter.

About two months, according to the time fixed or the particular instructions in the bulletin, the chairman is expected to visit the place where the institute is to be held. In our county, we generally appoint our local committees at the June meeting.

It is left to me, as chairman, to make these appointments when I visit these places where the meetings are to be held. I have already visited the two places where we are to give institutes the coming winter and appointed my local committees. I visit them at their grange meetings and appoint these committees. There were seventy-five members of the grange present, and it was advertised to seventy-five people right there. After I have appointed my committees I explain to them what is expected of them, that they will be expected to make all necessary arrangements for the preparation of the hall or place of meeting and for meeting the speakers and selecting the material for the program, that is the local papers, recitations and discussions. They get this work done at least a month before the meeting and send it to me, and I make up my programs myself. And right along that line I want to speak just a minute and say that if a grange will serve meals, or any society will serve meals, I advertise it in the program; and I want to say

right here that in appointing my committees I appoint good, large committees. I don't believe in just two or three; I appoint from eight to ten on my committees of the most representative farmers and their wives in that locality. That, I think, is a good plan; the other people see these names on there and they say, well, if they are interested in that I guess it is all right, and I guess we will go. I get not only fifty programs, but I calculate to get several hundred programs printed. It don't cost a great deal more to get several hundred than to get one or two hundred, even if you waste a part of them, I would rather waste a lot than not to have enough.

First, I get my committee to get a list of names, or get the chairman to go to the postmaster in the community where the grange is going to be held and get the postoffice address of every farmer, or go to the assessor and get the addresses in that way. When I get my programs ready I mail lots of them; I believe it pays to let them know what is going on. I get the programs ready a month before hand, so that I can send a few to the Department and a few to the speakers; then, later, I mail one to everybody whose address I have been able to get anywhere near the place where the meeting is to be held. I enclose, with the program, an invitation card. I have had some printed that suit me a little better than those furnished by the Department, although I use those too as far as they will go.

Now, when the large posters come, which the Department sends—those large ones—I used to fill up the blank spaces by hand, but last year I took them to our printer and got him to set the type so that with one impression he could fill in the date and place, etc., on the large programs, and paid him a dollar for doing it. It was a good deal plainer, better and cheaper than I could do it by hand. When I got these ready I posted them up, and then I sent one-half to my local chairman at one place and the other half to the other local chairman.

When I first organized my committee, I explained to them that I wanted them to be very careful in putting up these large posters, to put them up so they would stay; instructed them to put them up with lath or something on the top and bottom. The other day, as I was coming home from one of the places, I saw a poster of a farmers' institute, nice and white, clean and good, out on the south side of a building, where it stood the weather for nine months in our county. I wondered who had come into our county and was running an institute there. As I got closer I saw that it was one of my advertisements of my own institutes that I had put up nine months ago. It was put up, as I have said, with sticks on each side and top and bottom, and it stayed there. That is the way to put up these large posters.

That is about all I think of at present. I have prepared no paper and I do not think of anything more to say in regard to advertising the institutes. If there are any questions, I can answer them better.

MR. NORTHUP: I hope you won't think we send out only fifty programs and that that is the end of our work up there. That is only, in reality, just the beginning of it. I would neglect anything else rather than to neglect giving out those programs, and plenty of them. We always make it a point to attend to that and see that they are well distributed.

There is another thing. Allow me to just continue a little bit while I have the floor. We have to get all the chairs out and get them ready and properly arranged before hand, because there will be a crowd in there by and by, and if you attend to this in season and get everything in proper shape, why, then you can seat the people when they arrive.

The CHAIRMAN: Is our Committee on Resolutions ready to report?

MR. HILL, Chairman, Committee on Resolutions, presented the following:

RESOLUTIONS.

Whereas, The laws relating to hunting and fishing are, at this time, regarded by a large majority of the farmers of this Commonwealth as inequitable and possibly unconstitutional, and

Whereas, It is our desire to secure legislation that may relieve us of many perplexing conditions under which we now live, the damage we sustain, the danger to life and destruction of property, and earnestly desiring relief from these conditions;

Therefore, be it resolved, by members of this Normal Institute, That a committee be appointed to draft a bill that will be equitable, and restore to us the rights we are deprived of and should enjoy untrammeled by the unwise, unjust and inequitable legislation as it now exists.

Whereas, The equipment of the State College and Experiment Station for accommodating and instructing students is in no wise equal to the demands, and

Whereas, There is a growing demand throughout the State for enlarged facilities here for scientific agricultural education, and

Whereas, The college authorities have pledged themselves to give special attention to the training of youth for farm life, making ample provision for this special work as soon as funds are provided, and

Whereas, We believe that the wants and demands of this State will not have been met until this college is able to each year train

thousands of our boys and girls instead of hundreds, and that this State will not do its full duty until it puts hundreds of thousands of dollars into this work annually;

Therefore, be it resolved, That this body insists that the next Legislature make provision for carrying this into operation by an appropriation commensurate in amount to the importance of the subject and the needs at stake.

We thank the Bellefonte Central Railroad for courtesies extended us through its superintendent, Mr. Thomas.

We are grateful, further, to Mrs. H. A. Surface and others for music so nicely rendered.

Resolved, further, That we bespeak the continuance of the Normal Institute plan and bespeak a more generous appropriation for the work.

We sincerely appreciate the recognition and many courtesies extended to our body by Dr. Atherton, President of the Pennsylvania State College, and of others associated with him, in so efficiently carrying forward the good work now being done, and in contemplation by this institution.

Whereas, It is reported that an attempt will be made in Congress to repeal the Grout bill, recently enacted into law by the United States Congress;

Therefore, be it resolved, That we, the Farmers' Institute Managers and Lecturers of Pennsylvania, are unalterably opposed to any legislation to decrease the efficiency of this law.

Your Committee on Resolutions desire to congratulate the Board of Institute Workers and Managers upon the establishment of this important and efficient agency for the general promotion of approved advanced agricultural education and best methods for promulgating the same. It is a subject for congratulation that we have at our head, as Director of Institutes, a broad-minded, progressive, amiable man. We extend our thanks to the Department of Agriculture of Pennsylvania for its co-operation in this highly important educational movement.

To the local manager, Col. John A. Woodward, for the excellent arrangements made for the comfort and entertainment of those attending which contributed so much toward the unexcelled success of this institute, and to the commissioners of Centre county and the people of Bellefonte for courtesies received, we extend hearty thanks.

(Signed.) M. N. CLARK,
W. F. HILL,
G. G. HUTCHISON,
Committee on Resolutions.

The above resolutions were adopted as presented, with the exception of the one pertaining to the Grout bill, which, on motion, was so amended as to request the Senators and Members of Congress from this State to oppose its repeal.

ROUND TABLE ON COUNTY CHAIRMAN.

MR. STOUT: Mr. Chairman, I ask whether it would not be advisable to call the roll of those present and give them each a few minutes, so that they may have the opportunity to express their sentiments.

MR. SEXTON: Mr. Chairman, I think that suggestion of Brother Stout is a good one, because there are a whole lot of chairmen that we would like to hear from. We expect to hear from these chairmen; we do not all agree on the same lines and do not all work on the same lines.

MR. HERR: I think that the suggestion of Mr. Stout could hardly be carried out at this late hour. There are some very important questions that might be asked on this first topic. I have been in conversation with a number of the county chairmen, and have been asked quite a good many different questions, and some of those questions have not been touched by the gentlemen who spoke on that subject.

It was moved and seconded that the speeches be limited to three minutes each, and that the preference be given to those that have not already spoken. The question being put, it was agreed to.

PROF. HANTZ: I have been asked what I would do in case you ask some lady or gentleman to write a paper and that party never puts in his or her appearance. I had that experience. What are you going to do about that?

A Member: Let him go. Use the time for something else.

MR. McHENRY: Mr. Chairman, I hope I will not exceed the time. There are a dozen and one questions—more than that, that have not been touched on at all in regard to the making of programs, conducting our meetings and all those things, and whether a man is allowed to get up and talk for an hour and a half when others have not talked at all. I think one of the first things needed is a condenser, and I think it would have been of use right here, a lightning condenser. It does seem to me that if we put into use the education we have got, and take it home and give it to our people, we would have better institutes. I think it is the duty of the chairman to call down every man that is exceeding his limit and not allow a

man to talk when there are others that have not had the opportunity to talk at all. I know it takes nerve, especially with the State speakers, but it ought to be done. There is one question that I would like to know something about, and would like some one to tell me, and that is, what is the best manner of preparing a program? I will say this so that you will understand what I mean. I have always made it a rule to make use of our local talent as far as possible; have them take part. Now, I have been rather censured for allowing local talent to get on to questions that some fellow has been sent out there to take up, probably, with a great, long essay prepared, which he wanted to get off. I would like to know what the practice is on this question.

MR. OWENS: I think a good way is to make out a program and put on the hour when each speaker is supposed to speak to fill your program, and when the time is up, the chairman should close down. This gives the people outside an opportunity to know just when the subjects in which they are interested are to come up, and it enables them to plan to be present.

MR. FENSTEMAKER: What compensation shall the county chairman allow himself out of the appropriation for running the institute? In making my return after the institutes in Lehigh county, I had about $19 left, and it was suggested to me that it was an unusual occurrence, and from what I have heard from different chairmen in that matter, I think I am on the right track. Now, the question with me is, shall I raise the different items, advertising items, something for music, etc., so that something may remain for myself to pay for my services? Is that done? I would like to have the question answered.

The DEPUTY SECRETARY: I presume, so far as I am able to judge from the reports coming from the different counties, that a large portion of the work accomplished by the chairmen of the institutes of the different counties is performed without any remuneration whatever. In fact, I doubt very much if the institute managers, in general, receive enough personal funds to pay their actual meal expenses in this work—their dinners and suppers. I doubt it very much, and I regard the expenditure of $12.50 per day, which is devoted to this branch of the work, as a very light expenditure. My counsel to the chairmen of the institutes is, expend that money judiciously for the advancement of the work of the institutes in the several counties. Mr. Fenstemaker succeeded remarkably well, and I could not but commend him as an exceptional man in carrying on so good an institute; and in making that commendation it was no censure to the county chairmen elsewhere, most of whom expended

all this money and probably could have judiciously expended more for the promotion of the institute work.

Mr. Nelson stated that there was a great variation in expenses; that this year there were three institutes in the western part of his county; that he made three or more trips and that the best he could do as to expenses was at least $5.00 a trip and that he would not have had any money left if he had allowed himself anything at all; said he made it a point to have his account cover the $50 and if anything can be saved he makes a contribution of that to his county agricultural society; says that it really goes into the institute work, every dollar of it.

MR. SEEDS: I want to say that as I have traveled through life, there are two men I have always looked up to; one is the volunteer fireman and the other is a chairman of a farmers' institute. Something has been said this afternoon about cold halls, etc. In my experience, I have never found such a hall, but I have always found them heated in time and comfortable. You talk about advertising your institutes, you talk about doing this and doing that to make them better, but out our way they are crowded and you have to turn people away. In some places in Pennsylvania, I have known them to charge fifteen cents at the evening session and still keep the house crowded. The county chairman has done everything that he can do as far as I can see, and I look at him as I look at the volunteer fireman. At Tyrone there was a fire, and those volunteer firemen fought that fire and stopped it within a wall's breadth of my house. One more word I want to say. I do not know when I have attended a meeting that has been so much of an inspiration to me as this meeting has. I have gone along through life and tried to study the problems of agriculture and I am here to-day realizing that I have got started, realizing that I do not know anything compared with what is to be known in the future. I do not know when I have attended a meeting that has done me as much good as this meeting has, and I want to thank Brother Martin for keeping in line with New York and some of the other states, for I tell you we need it.

MR. KAHLER: I think a personal invitation is a good thing. I very much approve of the card business; I think that is a very good idea.

MR. STOUT: I want to say that I have a little thing here that will illustrate the idea of concentrating what is to be said on a subject in the fewest words. I often think of the words of Burns:

"O wad some power the giftie gie us
To see ourselves as ithers see us."

The story I have in mind is of a section foreman who used to send in very long reports to the superintendent of his division whenever an accident would happen on the road and the train get off the track. The superintendent finally got tired of these long-winded reports and instructed the foreman that when he had a report to make in the future, he should "boil it down." So not long after, when a train got off the track, the foreman reported as follows: "Off again; on again. Finnegan." I think this well illustrates the idea of concentration, and that it is something very much needed in our institute work.

MR. McCLELLAN: In our county, which is a pretty large county, we have a long ways to go from one institute to another. The distances vary from fourteen to twenty-three miles between the two institutes, which makes our county a very expensive county to hold institutes in. I make it a point to try and get the ministers interested as much as possible. I find if they take part, the rest of the people will take part. I am not a granger, and I do not recognize any organization at all in the business; I recognize the farmers and the farmers' general welfare and that is the way that I try to reach the people. Sometimes it costs us only $2.50, but generally we pay $5 for the building in which we meet.

The CHAIRMAN: Does your local committee ever run you up to $35 on an institute?

MR. McCLELLAN: I do not allow the local committees to run me up on anything. I pay for the house and pay for the transportation of the speakers.

A Member from Lancaster County: In our county we have a good deal harder work to get out a satisfactory attendance than in some of the other counties. I have a great deal of faith in the local farmers' clubs and in getting the young people enlisted, getting them out in the evening, if not in the day; then you get the older persons to bring their neighbors along and get these persons enlisted and interested in the work; tell them what is to be done. The manager of the institute should try to bring up those topics in which the people are most interested, for instance, we have a great tobacco growing county, so in our county it will interest the people if the speakers speak on tobacco.

MR. McGOWAN: I feel that Berks should have a word in this and I will concede what I might say to my friend, Dr. Funk.

DR. FUNK: Mr. Chairman, I don't know as I have much to say on this subject. I understood that this was to be for the county

chairman more especially. We have in our county such an efficient county chairman that I think our institute cannot help but be a success, and I appeal to Secretary Martin to say if we do not have a success in Boyertown.

MR. MARTIN: You certainly are all right there.

DR. FUNK: I would wish to say one word in regard to our method of advertising. We adopt this method: In addition to the programs, we get out a large number of additional programs, in addition to those assigned to the county chairmen of Pennsylvania. Last winter we had 4,000 printed; got these printed a while ahead, about a week before the time of the institute, and we have a large local committee, with about eighteen or twenty or more on it, so as to get a large number interested, over an area of twelve or fourteen miles. We get them together and divide up in school districts, and get each one to name all the public schools that come within his jurisdiction, and then we furnish all these schools with from twenty-five to fifty programs to be distributed in those schools—give them to the teachers, so that the teachers may give them out to the children to take home. Now, they read just what the whole performance is to be; they talk it over and know all about it. We find that when the day comes they just pour into us so that we can't accommodate them. We had to get the Lutheran church last year. Had over 900 people there, as Mr. Martin will tell you; he was there that evening.

The CHAIRMAN: With your permission, we will call on Mr. Hutchison to give a five minutes' talk on his work, if it is in order.

MR. HUTCHISON: This is somewhat of a surprise to me; I have kept quiet from the beginning of this institute and listened just as quietly as I could, but made a little noise sometimes, but have been very much interested in the work. I have been holding county institutes, or helping to hold them, for some seventeen years, and the trouble now is that we can't get houses large enough to accommodate the people. Our houses are always full.

The work that I am engaged in now for the Department of Agriculture is not a new work; it has been going on for some two years, I believe. It is new to the people generally; it has not been brought before the farmers of the State as it should be, I think, or they have not had the information that they should have in regard to it. The bulletins have been published and distributed, but it has not been placed before the public in the newspapers and the people have not been taking the interest in it that they will in the future.

In reference to the feed law, any feed that is prepared from whole

grain, such as corn, oats, rye, barley or any of the cereals is all right, but the moment that there is any mixture goes into it, such as bran or middlings or corn-cob meal or oat meal or any of those by-products from the oat meal manufacturers from the great State of Ohio, then the law lays its strong hand on the manufacturer, unless the packages show clearly what they contain. The law says that they shall give the amount of protein and the amount of fat that is in the chop or meal, whatever it may be.

The CHAIRMAN: Suppose the analysis is not placed on the back; how are we to proceed?

MR. HUTCHISON: I will take, for instance, the manufactory known as The American Cereal Company, in Chicago. Their manufactory is in Chicago and they have different mills throughout the United States. Now, if they put up a mixture they will have it analyzed, or should have it analyzed, and place it on the back of the sack the analysis, giving the protein and the fat, as I said before. They allow them in this State to place a tag on. They have a tag placed on the sack in place of the analysis being stamped on. The Secretary allows them to place a tag on with this analysis on it. I will say for the people who manufacture goods out of the State, the majority of them have the analysis on. I cannot say that the analysis that is found in the last bulletin compares exactly or that it comes up to the analysis that you see on the sack or bag. That is the matter that the Secretary is considering now, I believe about bringing suit against some of these people who are not complying with the law.

Send to the Department of Agriculture and they will mail you Bulletin 122. I want you all to send for this bulletin; it will give you a great deal of information on this subject. If you want more information, send for Bulletin 87; that is a larger bulletin and gives some of the percentages. Those interested in the value of different feeding stuffs should send for it.

PROF. WATTS: I would like to hear from Mr. Agee. I think he has had the most experience in institute work. We have had a great deal of valuable discussion during this hour and I would like to have Mr. Agee tell us what his idea is of the best way to run an institute from beginning to end. How an institute should be conducted, just a sentence or two on each point. I think he can do that; let us have that.

The CHAIRMAN: We should be pleased to hear from Mr. Agee.

MR. AGEE: If that subject had been given to me an hour ago, with the intimation that I was expected to spend five minutes upon

it, I might have done it, but I am afraid I couldn't do it justice without some little thought. The farmers' institute work has developed in recent years, and the variation in the development is one of the most curious things, as I have studied it in a number of states. We have some that are under autocratic rule absolutely from the central head, and our people say that that is all wrong, and yet when I have seen an institute so conducted, I have sometimes thought and said it is a mighty good thing to have some autocratic work in institutes, and yet you know I come from Ohio. I think that Pennsylvania has one of the best modifications of these various systems that you can find anywhere. You want a central head; you must have an organization and have the men capable of doing the work; otherwise it is not efficient or economical. On the other hand, institutes, as a rule, cannot be successful unless the local men take the heat and burden of the day and make them go. Well, now, how would I have an institute run? First, I would have a program suitable to the audience from beginning to end, regardless of the feelings of those who went on the program. That means just this, that if I had a local man who knew more, was a specialist, and knew more than the State lecturers knows on a certain subject, he would have just as much time on the program as the State lecturer. On the other hand, if I did not have that local man there, but had one who thought he knew as much, but really did not, and would be a bore, I tell you I would sit down on him and keep him off that program, even if I did have to live with him for the rest of the year. I dont believe any man is cut out for an institute worker unless it is in him to know when he is tiring his audience.

PROF. WATTS: I would like to say that I never attended a better Normal Institute than I have here in Pennsylvania. I don't say this was the best, but I do say that it has been very gratifying to me.

The DEPUTY SECRETARY: Mr. Chairman and Institute Chairmen and Lecturers and all interested: The past four days to me have been an inspiration in this work. I am impressed with the thought and idea that we, in Pennsylvania, have at least taken one step forward in the line of elevating agriculture, which is the burden of our work.

My friends, the photograph of your kindly feelings and courteous treatment, as well as the photograph of your presence and the work accomplished and carried through these four days, as presented in this program, is fixed in my mind, and I feel quite certain that at this particular time in the history of institutes in Pennsylvania, when we are approaching the season in which our instructors will

go forth throughout Pennsylvania, into the different counties, that they will go equipped as they never before have been to carry on and forward and ever advancing this great work. That is an inspiration to me, as well as a pleasing thought. And I will only add that the one thing that has nerved and strengthened and given to me energy and courage to attempt to move forward in this work is the support and courteous treatment extended to me by the County Chairmen of Institutes everywhere, without an exception. I do not feel that, as I look back over these five years, my friends, that I am deserving of the kind treatment bestowed. I think I can see many times in which I might have bettered the situation. I might have done some things that would have aided some county chairman, laboring and struggling under difficulties; I might, perhaps, have done something more helpful to him in his arduous work. On the other hand, I have seen some lecturers that I might have given a more helping hand at times.

I look back over all these things, and remember how kind and courteous you have been to me during all this arduous work and how, to-day, we are moving on heart and hand in this great work, the greatest ever entrusted to man for the advancement of mankind —the elevation of agriculture.

Now, thanking you for all the kindnesses extended, we shall separate from this place, so far as I am concerned, with the kindest feelings and the brighest hopes for our advancement in the future.

On motion, the Normal Institute adjourned.

A. L. MARTIN,
Secretary.